RADISE International

Geotechnical and Software Consultants

April 28, 2005
RADISE Project No: 04/BR/Geot/0701

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RE: Report of Geotechnical Services for Basis of Design
STA 2/Cell 4 Expansion Project
Palm Beach County, Florida
Contract No: CN-040935
Work Order No. 4

Dear Mr. Siegfried:

RADISE International (RADISE) is pleased to present 20 copies of this Report of Geotechnical Services for the Basis of Design (BODR) phase of the above referenced project. RADISE has completed the Geotechnical Services in accordance with Work Order No. 4 with authorization date of January 05, 2005.

We appreciate the opportunity to work with you on this project, and trust that the information herein is clearly presented. Should you have any questions, please contact us at (561) 841-0103.

Sincerely,

RADISE International
Geotechnical Engineers & Software Developers

Vamsi Vanama
Project Engineer

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Sr. Geotechnical Engineer
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RADISE
Infrastructure Engineers + Software Developers

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1.0 INTRODUCTION

1.1 Project Information

1.1.1 STA-2

Storm Water Treatment Area Two (STA-2) was constructed to fulfill the goals of the 1994 Everglades Forever Act to improve water quality in the Everglades. The STA-2 Project consists of the S-5A Basin Runoff Diversion Works, the S-6 Diversion Works, the STA-2 Supply Canal Works, the STA-2 Inflow Works, the STA-2 Interior Works, the STA-2 Discharge Works, the G-335 Pump Station, and the Water Conservation Area 2A (WCA 2A) Hydropattern Restoration Works.

1.1.2 STA-2 Expansion Project

Land, referred to as "Compartment B", was identified initially for use as part of the Everglades Agricultural Areas (EAA) Storage Reservoir Project. Subsequent analyses performed in support of that project determined that Compartment B land is not required to satisfy water storage objectives, making it available for use by the South Florida Water Management District (District) for water quality purposes. The Compartment B Expansion Project will provide over 9,500 acres of additional wetlands treatment area for further reduction of phosphorus levels in the Everglades Protection Area. An initial 2,015-acre expansion of STA-2 (Cell 4) has been proposed by the District in modifications to the Long Term Plan to assist in satisfying the water quality goals of the Everglades Forever Act by December 2006.

Basic project components include the following:

- Extension of the existing STA-2 inflow canal from its current point of terminus to the proposed north perimeter of Cell 4.
- Construction of a new perimeter levee and inflow control levee along the northern boundary of Cell 4. Inflow structures are to be located within the inflow control levee and will be used to regulate inflows to Cell 4.
- The existing North New River Canal levee will be utilized as the western project boundary, or the project will consist of the construction of a new western levee for this purpose.
- The south perimeter of the project will include a new levee and new collection canal that will be tied into the existing discharge canal for STA-2.
- The eastern boundary will abut the existing western perimeter levee and seepage collection canal for Cell 3 of STA-2.
- Discharge structures will be located along the south perimeter and will be used to regulate discharge from Cell 4 and surface water levels within Cell 4.

This report is for Cell 4 and is intended to provide the necessary geotechnical data to support design through the Basis of Design Report (BODR) phase of the project to complete 30 percent design.

1.2 Regional Geology

The everglades system lies within a geological depression which runs south from Lake Okeechobee down to the center of South Florida. The Everglades, a sawgrass marsh with hammocks of willow, myrtle and bay tree, lies between two slightly higher areas on the east and west. To the west lies exposed Pliocene limestone of the Big Cypress Ridge. To the east lies late Pleistocene quartz sand and oolitic limestone, the Atlantic Coastal Ridge. The floor of the Everglades is essentially flat and overlain by fairly uniform mantle of muck and peat. Freshwater peat and calcite mud deposits from the Holocene epoch fill the depression. The surface organic from the Holocene epoch fill the depression. The surface organic soils (peat and muck) have accumulated in a layer up to 18 feet thick in the Northern Everglades, where bedrock elevations are the lowest, and thinner than 3 feet in the Southern Everglades.

Organic surface soils and peat are formed primarily in shallow freshwater lakes or marshes which are inundated/flooded for much of the year. The growth, death and decay of marsh vegetation over thousands of years are responsible for the accumulations of up to 10 feet thick deposits of organic muck or peat south of Lake Okeechobee. The principal vegetation that accounts for formations of peat in Everglades is sawgrass. Historically, peat accumulation on the Everglades proceeded at a rate of about 3.3 inches every 100 years. By 1914, organic soil accumulations in the everglades reached their recorded maximum average thickness of 134 inches.

In 1975, the US Department of Agriculture, Soil Conservation Service (USDA, SCS) (McCollum et al. 1878) mapped the EAA as part of a soil survey for Palm Beach County. Seven basic surficial soil types are recognized in the EAA, Torry muck, Terra Ceia muck, Pahokee muck, Lauderhill muck, Dania muck, Okeelanta muck and Okeechobee muck. The Terra Ceia and Pahokee series represent about 80 percent of the soils and Pahokee series represent about 80 percent of the soils present in the EAA. Classification of these soils is largely based on soil properties and their depth to the limestone bedrock, with Terra Ceia and Okeechobee muck representing the deepest soils (more than 96 inches), followed by Pahokee muck (between 36 and 96 inches), Lauderhill muck (between 20 and 36 inches) and Dania muck are the shallowest (less than 20 inches). Soils in the Okeelanta series contain low-ash muck 16 to 40 inches deep over sand. Torry muck represents soils derived from custard apple forests once located on the southeast corner of Lake Okeechobee.

2.0 SITE CONDITIONS

2.1 Site Description

The site encompasses approximately 2,015 acres of abandoned sod and sugar cane fields with their associated network of drainage ditches and structures, which control and generally lower the natural high (shallow) water table. Wildlife such as deer, bobcats, alligators, snakes, turtles and herons were observed during our exploration. Cell 4 layout is shown on **Sheet 1** in the **Appendix A**.

2.2 Site Reconnaissance

After our initial meeting with our prime consultant Brown & Caldwell and the South Florida Water Management District (SFWMD) in July 2004, representatives of RADISE made several visits to the project site for the purpose of Site Reconnaissance and to coordinate the field investigation with the representatives of the District & Woerner property. Our observations during these visits are summarized in the sub-sections below.

2.3 Areas/Regions/Accessibility

For the purpose of geotechnical field exploration, the complete project area was divided into different regions based on the accessibility and mobilization efforts required. For the majority of the field exploration, track mounted drilling rigs were required to perform the field geotechnical exploration work. Areas along the North-South Inflow canal in the Woerner property and collection canal south of STA-2 were explored by a mud bug mounted drilling rig.

2.4 Existing Vegetation

The project area can be divided into two primary regions based on the current usage of land, namely: active sod farms and abandoned sugar cane and sod farms. Proposed Cell 4 interior and area along the proposed collection canal were predominantly abandoned sugar cane and sod farms. Areas along the proposed Inflow canal are active sod farms and heavily vegetated berms.

2.5 Existing Topography

The project area is relatively flat with farm access roads and networks of drainage ditches and structures to control and generally lower the naturally shallow water table. Boring locations, elevations and topographic information obtained from project surveyor Weidener Surveying and Mapping, P.A. (WSM) indicates that the elevation in the vicinity is about +7 to +9 feet with respect to North American Vertical Datum of 1988 (NAVD 88).

2.6 Existing Farm Ditches

The existing excavations have been made through the surficial muck and upper layers of the limestone. The invert depths of these canals are on the order of 2 to more than 6 feet below surrounding grade. The side slopes of these canals have been observed to be almost vertical. A close observation of the surface of the side slopes indicate that the limestone layer is made of interbedded layers of sands and hard limestone.

2.7 Existing Berms, Mounds & Farm Access Roads

The existing berms, mounds & farm access roads (berms) are constructed of fill soils probably borrowed from adjacent canal excavations. These berms are placed over the muck, and are generally 2 to 4 feet high alongside canals. Most of these berms are heavily vegetated and are not drivable.

2.8 Borrow Lake (Fish pond)

An approximately 33-acre pond is located near the southwest corner of the proposed Cell 4 footprint. The pond has bottom elevations in the range of -15 to -20 feet NGVD. Reportedly, the pond has been utilized for fish farming operations at various times in the past.

3.0 RESEARCH OF EXISTING DATA

We reviewed published data and existing SFWMD project reports. The purpose of this research was to obtain a better understanding of the existing site conditions prior to commencing any field exploration. Key findings from that research are described below.

3.1 Legal Description

The Cell-4 site is located east of North New River Canal and west of Cell 3 of STA-2. The legal description of the project falls in Palm Beach County, Florida under:

- Sections 31, 32 and 33 in Township 46 South and Range 38 East
- Sections 5 and 6 in Township 47 South and Range 38 East

3.2 Soil Survey

The U. S. Department of Agriculture, Soil Conservation Service (USDA, SCS) Soil Survey of Palm Beach County Area, Florida, issued December 1978, shows the Cell-4 site to be underlain by three soil units; Lauderhill muck, Pahokee muck and Pits. The Cell 4 USDA soils map is presented on **Sheet 2** in the **Appendix A.**

- Lauderhill muck: This unit is described in SCS as a nearly level, very poorly drained, deep, organic soil that rests on limestone at a depth of 20 to 36 inches. This soil is in broad, freshwater marshes and formed in moderately thick deposits of well-decomposed remains of hydrophytic plants overlying limestone.

- Pahokee muck: This unit is described by the SCS as a nearly level, very poorly drained, organic soil that rests on limestone at a depth of 36 to 51 inches. This soil is in broad, freshwater marshes. It has the pedon described as representative of the series. Under the natural conditions, the soil is covered by water or the water table is within 10 inches of the surface for 6 to 12 months in most years, except during extended dry periods.

- Pits: Pits consist of excavations from which soil and geologic material have been removed for use in road construction.

3.3 Existing SFWMD Geotechnical Information

We reviewed the following geotechnical reports for projects within the vicinity of Cell 4 for general surficial and subsurface conditions. Summarized information from these reports is presented in the subsequent sections.

- Final Geotechnical Report, STA-2 and Water Conservation Area 2A Hydropattern Restoration, dated June 1997, prepared by Brown and Caldwell.

    - Topographic information obtained from borings indicates that the ground surface elevations of the existing west most levee of the Cell 3, ranges from approximately +9 feet to +10 feet NGVD 29.

    - Subsurface materials found in the borings generally consisted of 1 to 8 feet of silty organic sand to fibrous peat over limestone and then sandy silty limestone.

    - The measured depths to the water table ranged from 1.5 feet to 6.7 feet below the ground surface.

- Subsurface Exploration Report, Woerner South Property (STA-2 Expansion Taking Area), Palm Beach County, Florida, dated December 24, 1997, prepared by Ardaman & Associates, Inc.

    - Fifteen SPT and fourteen auger borings and 250 muck probes were performed in the sod fields during December 1997.

    - General subsurface exploration results indicates that a surficial layer of organics (muck) varying from 0.5 feet to 2.5 feet was underlain by a marly limestone formation (caprock) and then by gray fine sands with shells and cemented sands and shell (shellrock) to depths of more than 30 feet.

- Subsurface Exploration Report, Woerner South Property (Remaining Area), Palm Beach County, Florida, dated April 28, 1998, prepared by Ardaman & Associates, Inc.

    - Thickness of the surficial organic layer was measured by 708 muck probes during April 1998. The subsurface exploration results indicates that sod and sugar cane fields on this site underlain by a surficial layer of organics varying from 0 feet to 4+ feet are with an average thickness of about 14 inches.

    - Laboratory test results indicate that the representative organic samples have moisture content varying from 213.4 to 345.0% and organic contents varying from 57.4 to 87.2%.

- Factual Report Submittal, Offsite Seepage Study, STA-2, dated January 21, 2000 prepared by Dames & Moore.

    - A single Standard Penetration Test (SPT) boring was drilled on the existing inflow control mound, just west of the seepage canal and west levee of Cell 3, located just east of the Cell 4 site. The boring was drilled to a depth of 100 feet below existing ground surface.

    - Subsurface materials found in the boring generally consisted of man made fill (used to construct the inflow control mound) over natural peat, limestone caprock and then interbedded sand and limestone.

    - The coefficient of permeability values for other piezometers installed at STA-2 ranged between about 1 to 78 feet per day.

- Report of Subsurface Exploration & Geotechnical Evaluation, STA-2 – Proposed Culvert dated September 29, 2003, prepared by Nodarse & Associates, Inc.

    - Twelve SPT borings and one hand auger boring were drilled by Nodarse & Associates Inc. during August, 2003. All the borings were drilled along the east-west direction in the interior of the cells 1, 2, and 3 of the existing STA-2 project. The borings were drilled to a depth of 30 feet below standing water. A single hand auger boring was drilled to a depth of 7 feet below the standing water.

    - Standing water, between approximately 1 and 7 feet in height, was observed and measured in the areas of the borings.

    - The water was underlain by peat, which was between 1 and 5 feet thick.

- Report of Final Subsurface Investigation and Geotechnical Evaluation, STA-3/4 and East WCA-3A Hydropattern Restoration dated March 23, 2001, prepared by Nodarse & Associates, Inc.

    - Subsurface conditions within STA-3/4 consisted of a surficial layer of organics (peat) varying from 0 to 5 feet which were underlain by a limestone varying from 5 to 20 feet thick. The consistency of the peat determined from obtained SPT blow counts, was found to be very soft to soft.

4.0 FIELD EXPLORATION

The subsurface conditions of the Cell 4 site were explored with muck probes, Standard Penetration Test (SPT) borings and rock core borings.

4.1 Muck probes

Muck probing was performed at sixty-one locations during the month of October 2004. Surface water levels and muck depths were recorded for each muck probe location. Probe layout procedure, locations and methodology adopted is described below.

- Muck probe locations were spaced approximately 1,500 feet to 3,000 feet apart in an east-west direction and probes were also located at a distance approximately 30 feet away from the toe of the east-west oriented farm berms in the interior of Cell 4.
- Muck depths were probed by pushing a hand held 3/8-inch diameter steel rod into the soft soils (natural ground surface) to refusal at the top of the underlying rock (caprock) layer. The depth was recorded as the thickness of muck and/or organic silty sand.
- Muck probes locations were recorded using a hand held GPS device.
- The obtained geographic co-ordinates were converted into state plane co-ordinates NAD 83, Florida East - 0901 and U.S. Survey Feet, using software Corpscon for Windows 5.11.08.

The depth was recorded as the thickness of muck and/or organic silty sand. The minimum, maximum and average depths of the muck recorded are 0, 48+ and 14.1 inches, respectively. Muck profiles including locations are presented on **Sheets 3A through 3E** in the **Appendix B**. Results of the muck probes are presented in the **Tables B1 through B7** are presented in the **Appendix B**.

4.2 SPT and Rock Core Borings

Boring locations were established jointly by Brown and Caldwell and RADISE. The project surveyor WSM established the ground surface elevations at the boring locations. The subsurface profiles are plotted to elevation using the NAVD 88 Datum. The Boring location plan is presented in **Sheet 4** of the **Appendix C**. Field Exploration Information including co-ordinates and elevation is presented in **Table C1** of the **Appendix C**. SPT and Core boring profiles plotted using AutoCAD are presented on **Sheets 5A** through **5F** of the **Appendix C**. Individual SPT and core boring profiles plotted using GINT are also presented in the **Appendix C**. All borings were properly grouted upon their completion. The following subsections explain in detail the work performed in the field.

4.2.1 SPT Borings

The subsurface exploration at the site included a total of fourteen SPT borings performed in general accordance with ASTM D 1586.

- Twelve SPT borings were drilled to depths of 25 feet below existing grade. They were located along the proposed levee and/or canal alignments. Eight SPT borings were drilled along the Inflow Canal alignment and four along the Collection Canal alignment.
- Two SPT borings were drilled to depths of 50 feet below existing grade. They were located within the Cell 4 interior, south of the existing fish farm.

Samples of the in-situ materials were recovered at frequent vertical intervals using a standard split-barrel driven with a 140-pound hammer freely falling 30 inches. All SPTs completed for this study were performed continuously to a depth of 10 feet and at roughly 2.5-foot depth intervals thereafter. Between sampling intervals, the borings were advanced with a 2 3/8-inch diameter tricone roller bit. A dense bentonite slurry was circulated in the boreholes as they were advanced to remove drill cuttings and maintain sidewall stability.

Samples recovered from the borings were field classified, placed in moisture-proof jars and returned to the laboratory for review by a geotechnical engineer.

4.2.2 Rock Core Borings

The subsurface investigation at the site also included a total of ten rock core borings performed in general accordance with ASTM D 2113-99 procedures. The percent recovery ratio (REC) and the rock quality designation (RQD) were measured in our laboratory by a geotechnical engineer. Photographs of the recovered core samples are attached in the **Appendix C**.

- Five core borings were located along the Inflow Canal and five along the Collection Canal.
- In each of the core borings, four 5-foot core runs were performed from the top of the caprock. Coring termination depths varied for different locations in accordance with the existing surficial peat thickness.
- The borings were advanced by spinning a high-speed rotary HQ diamond studded core barrel in five-foot increments. For each foot run, coring times and applied downward pressure were recorded.
- Retrieved rock cores were placed within wooden compartmentalized boxes. The wooden compartmentalized boxes were then transported to the RADISE laboratory for photographing, classification and testing.

5.0 LABORATORY DATA

5.1 Laboratory Testing

In the initial stages of the project it was decided that muck will be removed along the levee alignments. Therefore, limited testing was performed on the surficial muck. The following laboratory tests on muck were not within the scope of work and therefore not performed.

- Strength Tests
- Consolidation (compressibility) Tests
- Permeability Tests

5.1.1 Visual Classification

The samples obtained from SPT borings were visually examined and classified in accordance with the Unified Soil Classification System (ASTM D 2487) and geologic nomenclature. Undisturbed limestone samples obtained from core borings were visually examined according to geologic nomenclature, drilling time, measured REC and RQD data.

5.1.2 Soil Samples

Selected samples of the soil recovered from the borings were tested to provide information to aid in their classification. The following tests were performed:

- 17 Moisture Content Tests (ASTM D 2261)
- 12 Organic Content Tests (ASTM D 2974)
- 3 Gradational Properties Tests (sieve analysis ASTM D 422)
- 2 Percent of Material Passing No. 200 Sieve (ASTM D 1140)

Ranges of the results of the tests are summarized in the following table.

Soil Strata*	Moisture Content (%)	Organic Content (%)	Amount Passing Sieve Size (%)		
			#4	#40	#200
1A	102.5 – 179.7	31.7 – 68.4	-	-	-
1B	26.9 – 73.4	12.1 – 81.8	-	-	-
3	4.2 – 10.5	-	52.4 – 96.9	29.6 – 51.6	5.8 – 18.5

* See section 6.1 for soil strata details

Results of the tests indicate the sands to be mostly slightly silty to silty and well-graded with gravel and silt, while organic soil samples are highly organic muck. Summary of laboratory test results are included in the **Table D1** in the **Appendix D**. Gradational properties test results are also presented graphically in the **Appendix D**.

5.1.2.1 Environmental Classification

Twelve samples recovered from the borings were analyzed for corrosivity and aggressivity parameters that include pH, chloride content, sulfate content and resistivity. Each sample was classified according to criteria utilized by the FDOT for bridge substructures and other steel reinforced concrete structures in direct contact with soil.

Based upon the test results, the corrosivity/aggressivity potential of the soils is classified as "Moderately Aggressive" for substructure environmental classification. This is due to electrical resistivity less than 3,000 ohm-cm and pH value greater than 5.0. A summary of laboratory test results are included in **Table D6** in the **Appendix D**.

5.1.3 Rock Samples

The transported rock cores in the compartmentalized boxes were photographed in our laboratory prior to visual examination and testing. The percent recovery ratio (REC) and Rock Quality Designation (RQD) were determined for each core run performed. REC and RQD values of each individual core run and measurements are included in **Table D2** in the **Appendix D**. REC and RQD variation with depth for each boring and the entire explored area are included in **Table D3** in the **Appendix D**. Unconfined Compressive Strength and Splitting Tensile Strength tests were performed on selected rock core specimens.

5.1.3.1 Recovery Ratio

The lower boundary, upper boundary and mean percent recovery ratios of all the cores were found to be 49, 73 and 63, respectively. Summary of RECs combined for all the core borings with respect to depth are presented in the following table.

Approximate Depth Range (feet)	% Recovery with Depth		
	Lower Boundary	Upper Boundary	Mean
3 – 8	48	95	76
8 – 13	55	93	79
13 – 18	22	73	47
18 – 23	22	92	51

5.1.3.2 Rock Quality Designation

The lower boundary, upper boundary and mean percentage RQDs of all the cores were found to be 23, 52 and 36, respectively. Summary of RQDs combined for all the core borings with respect to depth are presented in the table below.

Approximate Depth Range (feet)	% Rock Quality Designation (RQD) Data w.r.t. Depth		
	Lower Boundary	Upper Boundary	Mean
3 – 8	21	67	47
8 – 13	15	78	43
13 – 18	8	53	24
18 – 23	14	80	32

5.1.3.3 Unconfined Compressive Strength

A total of 27 rock samples were tested for unconfined compressive strength. For samples with L/D (Length/Diameter) ratio less than 2, the unconfined compressive strength was corrected in accordance with ASTM D 2938-95. The lower boundary, upper boundary and mean unconfined compressive strength values were found to be 368, 13,411 and 3,911 psi, respectively. **Table D4** in the **Appendix D** provides the laboratory test data for each individually tested core sample.

5.1.3.4 Splitting Tensile Strength

A total of 46 rock samples were tested for splitting tensile strength. The lower boundary, upper boundary and mean splitting tensile strength values were found to be 83, 1,927 and 759 psi, respectively. **Table D5** in the **Appendix D** provides the laboratory test data for each individually tested core sample.

6.0 SITE SUBSURFACE CONDITIONS

The uppermost natural soil layer which is exposed at the ground surface generally consists mostly of fibrous peat and occasionally grades to a highly organic silt beneath the peats and above the limestone.

Moderately to strongly cemented limestone underlies the organic layer and extends to the terminal limits of the borings. The borings showed generally strong limestone for a depth of about 16 feet below the organic soils followed by alternating layers of very well cemented limestone and moderately well cemented silty, calcareous sands with limestone. Details are presented in the following section.

6.1 Stratification

Subsurface materials found in the borings generally consisted of about 2 to 4 feet (thick) of organic silt and clay to fibrous peat (muck/peat). These surficial soils were underlain by well cemented limestone which extended to the maximum depths drilled. In the deeper borings, a 10 feet thick layer of sand was encountered approximately 25 to 35 feet below surface grade. Due to the presence of limestone fragments in the samples, there may be thin limestone layers or more extensive weak very sandy limestone layers within this 10 feet thick layer. The samples were identified to be primarily of three different types. They are provided in the table below:

Primary Stratum No.	Approximate Depth Interval (feet)	Description
1	0 - 3	Organic Soils (Muck/Peat)
2	3 – 25	Limestone Formation
3	25 – 35	Slightly silty to silty SAND with limestone seams and shell
2	35 – 50	Limestone Formation

The primary strata were further classified for easier identification. The organic soils were sub-classified based on their fibrous nature. The letter “A” indicates a fibrous peat material and the letter “B” indicates a less fibrous and generally more silty material with generally higher moisture content than “A” material. The limestone formation was sub-classified based on the degree of cementation of the limestone and percentage of minority constituents. Letter “A” indicating the limestone is more intact when compared to “B”. The sub-classifications are presented in the table below.

Stratum No.	Description
1A	Dark Brown fibrous peat with traces of organic silt and clay (PT.)
1B	Dark Brown organic silt and clay with some fibrous peat (PT.)
2A	Gray, Brown and Tan Limestone
2B	Gray to Tan silty to slightly silty calcareous sand (SM) and limestone seams and shell
3	Gray, Green slightly silty to silty fine sand with limestone seams and shell (SP-SM)(SM)

6.2 Groundwater

Generally, standing water was observed during the muck probes. Water levels ranged from 0 to 1.5 feet above the ground surface at probe locations. The difference in standing water levels is likely due to topographic differences across the site.

At the time of drilling the borings, water levels ranged from +2 (standing water) to 1.5 feet below the ground surface. At locations where standing water was absent, groundwater levels were measured in the boreholes when the water surface was first encountered. The difference in groundwater levels is likely due to topographic differences across the site.

Based upon ground elevation data obtained from WSM, water table elevations in the site area typically range between +4.9 and +11.0 feet NAVD 1988.

6.3 Soil Strata Properties

Typical values for various properties of selected strata are presented in the following tables.

SPT N Value

Strata	Minimum Value	Maximum Value	Average Value
1A/1B	2	10	5
2A	12	50/5"	50/3"
2B	4	50/0"	18
3	10	30	21

The SPT N-values indicate the sands to be medium dense to dense in terms of relative density and the limestone to be well cemented to very well cemented (i.e., hard).

Coring Time/One Feet (Min:Sec)

Strata	Minimum Value	Maximum Value	Average Value
2A	0:15	10:40	3:28
2B	0:15	4:47	1:07

Index/Strength Properties - Strata 1A/1B

Property	Minimum Value	Maximum Value	Average Value
Moisture Content (%)	26.9	179.7	105.6
Organic Content (%)	12.1	81.8	51.5

Rock Core Data (Strata 2A & 2B)

Strata	Minimum Value	Maximum Value	Average Value
Recovery (%)	21.7	95	63.3
RQD (%)	7.5	79.8	36.4
Unconfined Compressive Strength (psi)	368	13,411	3,911
Splitting Tensile Strength (psi)	83	1,927	759

6.3.1 Geotechnical Design Parameters

6.3.1.1 Comparison of Geotechnical Design Parameters

The design parameters used in the seepage, slope stability, and settlement analyses were derived from our field and laboratory data and review of STA-2 and STA-3/4 geotechnical reports.

STA-2 Geotechnical Design Parameters

Soil Type	Unit Weight (lbs/ft^3)		cohesion (psf)	Angle of Internal Friction (degrees)
	Moist	Saturated		
Compacted Fill	NA	NA	100	33
Peat	NA	NA	250	20
Limestone	NA	NA	10,000	45

Note: NA – Information of soil unit weight is not available from Final Geotechnical Report, for STA-2.

STA-3/4 Geotechnical Design Parameters

Soil Type	Unit Weight (lbs/ft^3)		cohesion (psf)	Angle of Internal Friction (degrees)
	Moist	Saturated		
Compacted Fill	115	122	0	33
Peat	68	80	100	12
Limestone	140	150	9999	45

6.3.1.2 Cell 4 Geotechnical Design Parameters

A compilation of the field, laboratory data, STA-2 and STA-3/4 laboratory data, construction engineering inspection data from STA-2 and our experience has been utilized to estimate geotechnical design parameters. The summary of the soil design parameters used in our analyses are presented in the following table.

Cell 4 Geotechnical Design Parameters

Soil Type	Unit Weight (lbs/ft^3)		cohesion (psf)	Angle of Internal Friction (degrees)
	Moist	Saturated		
Compacted Fill	115	122	100	33
Peat	68	80	100	12
Limestone	140	150	9999	45

From STA-2 Consolidation Test Results of Peat			
Moisture Content (%)	157	700	498.8
Organic Content (%)	76	92	83.4
C_c	0.66	6.16	3.9
C_v (ft^2/day)	0.2	2.4	1.55

7.0 GEOTECHNICAL ENGINEERING ANALYSES

7.1 Site Suitability

The Cell 4 site which mainly consists of muck with a standing water level above the ground surface, presents challenges to the anticipated earthwork plan and requires special measures in both design and construction.

Based on the cross-sections provided to us, we understand that the construction of all levees will be directly on top of the peat layer. These cross-sections are presented in **Sheets 6A through 6D** in **Appendix E**. The levees will be stable, but they will settle appreciably. Most of the settlement will occur quickly, and it should be compensated for by overbuilding of the levee.

The well-cemented Limestone formation will be a source of select fill and will be used as the borrow material for the construction of the levees. Based on our experience with the carbonate rock material (e.g. limestone) encountered and experience obtained from the construction of STA-2 and STA-3/4, the material will require blasting facilitating economical construction if the material exhibits either of the following properties:

- SPT N-Values greater than 25 blows per foot.
- Coring rates of less than 1 foot per minute with a downward drilling pressure ranging from 400 to 500 psi.

We anticipate that the limestone materials when excavated will contain some oversize particles (i.e. those with the largest dimension exceeding 24 inches) owing to the cemented nature of the carbonate rock. The percentage of unusable (oversize) materials can be minimized if the large particles are passed through a crusher or broken down by track rolling with a heavy bulldozer. We recommend applying a shrinkage factor of 5 to 10 percent to the in-place volume of the materials to be excavated to account for compaction and also waste due to the oversized materials (limestone boulders).

7.2 Slope Stability Analyses

A compilation of the field, laboratory data and our experience with other STAs has been utilized in the modeling and slope stability analysis. A total of 5 generalized cross-sections presented on **Sheets 6A through 6D** in the **Appendix E** for different water levels and muck depths were analyzed using the computer program STABL6H and calculated by the Modified Bishop's Method. Geometries of all the levees and canals presented in these cross sections were finalized by Brown and Caldwell. The cross sections are as follows:

- North Side of Interior Levee in Cell 4 - North Boundary
- Inflow Canal in Cell 4 - North Boundary
- Interior Levee and Inflow Canal in Cell 4 - North Boundary
- South Side of Interior Levee in Cell 4 - North Boundary
- Existing Levee in Cells 2, 3 - South Boundary

Variables in the analysis are soil and rock properties, slope geometry, water levels and critical failure surface limits. The table below shows the soil parameters used for the analysis.

Soil Type	Steady State/Rapid Drawdown				End of Construction			
	Unit Weight (lbs/ft^3)		Cohesion (psf)	Angle of Internal Friction (degrees)	Unit Weight (lbs/ft^3)		Cohesion (psf)	Angle of Internal Friction (degrees)
	Moist	Saturated			Moist	Saturated		
Compacted Fill	115	122	100	33	115	122	300	0
Peat	68	80	100	12	60	80	200	0
Strata 2A	140	150	9999	45	140	150	9999	45
Strata 2B	138	140	9999	36	138	140	9999	36

Different water levels were analyzed for each condition presented in the table below.

Analysis Condition	Elevation feet - NGVD	
	Upstream Water Level	Downstream Water Level
End of Construction	10.0	10.0
Steady-State Seepage	*18.5, **13.5	*18.5, **13.5
Rapid Draw Down	*18.5/10.0, **13.5/10.0	*18.5/10.0, **13.5/10.0

Note: * - Maximum Water Level
**- Design Water Level

7.2.1 Levee Slope Stability Analyses

Levee stability analyses were performed with soil strength values that are suitable for levee fill over three different muck depths of 2, 3 and 4 feet. The maximum water level elevation was taken as +18.5 feet for a 500 year type flood and the design water level elevation as +13.5 feet. The analyses were performed with the phreatic line in the levee assumed to be linear sloping between the upstream elevation to toe of the slope. **Sheet 7** in **Appendix E** is the schematic diagram for the slope stability. Each of the levee sections were analyzed for slope and foundation failure for the three generally recognized critical stages based on pore pressure conditions. These are described as follows:

7.2.1.1 End of construction (EOC)

The EOC condition simulates the levee condition immediately after completion of the levee. Pore pressures usually reach their maximum values when the levee reaches maximum height. The upstream and downstream slope stability is critical for the EOC condition.

7.2.1.2 Steady-State Seepage

After the cells have been filled with water for a long time, pore pressures are determined by steady-state seepage conditions where gravitational flow conditions govern. The down stream slope stability is critical for the steady-state seepage condition.

7.2.1.3 Rapid Drawdown

Rapid lowering of the water level in the cells produces this condition. The upstream slope stability is critical for the rapid drawdown condition particularly for slow-draining soils.

Each of these conditions represents a period of time when the soil strength parameters and/or the surface water conditions are unique.

7.2.1.4 Minimum Factor of Safety

The minimum factor of safety allowed depends on the hazard involved with a failure as well as on the method of analysis, the reliability of the measured strength parameters, and the estimated pore pressures. Suggested minimum safety factors for levees (earth dams) are assuming the use of Bishop's modified analysis. The suggested minimum safety factors are from the following references.

- Embankment slope stability evaluations followed procedures described in EM 1110-2-1902, "Slope Stability" dated October 31, 2003.
- Design and Construction of Levees, EM 1110-2-1913, dated April 30, 2000

Analysis Condition	Required Minimum Factor of Safety Slope	Slope
End of Construction	1.3	Upstream and Downstream
Steady-State Seepage	1.4	Downstream
Rapid Draw Down	1.0 - 1.2*	Upstream

*Note: Factor of Safety = 1.0 applies to drawdown from Design Water Level.
Factor of Safety = 1.2 applies to drawdown from Maximum Water Level.

Summary of Slope Stability analyses are presented in the tables in the following sections.

7.2.2 Typical Levee & Canal Sections

Based upon information provided to us by the project design team, **Sheets 6A through 6D** in the **Appendix E,** we understand that the perimeter levees will have a crest width of 14 feet, elevation of +19 feet NGVD. The levees will have a design side slope of 3:1 (horizontal: vertical). A 20-foot wide bench will be constructed between the toe of the levee and the top of bank of the adjacent inflow and/or seepage collection canal. A bench width of 70 feet is planned for the north perimeter between the exterior levee and the seepage collection canal. Excavations for the canals will generally bottom between elevations 0 and -5 feet NGVD. Canal cut side slopes are designed to be 2:1 to 2.5:1 (horizontal:vertical).

Factors of Safety for a Typical Levee Side Slope

	Maximum Water Level			Design Water Level		
	End of Construction	Steady State Seepage	Rapid Draw Down	End of Construction	Steady State Seepage	Rapid Draw Down
Water Level (feet, NGVD)	**10.0**	**18.5**	**18.5/10.0**	**10.0**	**13.5**	**13.5/10.0**
Muck Thickness (feet)						
4	1.3	1.5	1.2	1.3	1.8	1.5
3	1.5	1.5	1.3	1.5	1.8	1.6
2	1.9	1.9	1.6	1.9	2.4	2.0

The levee slope stability analysis results are detailed in **Tables E1 through E10** in the **Appendix E**.

7.2.3 Canal Slope Stability Analyses

Canal slope stability was analyzed for different side slopes and canal depths. The analysis was performed for two water conditions, one for normal operation with water to the crest elevation and the other for dewatered condition with the canal being empty.

Factors of Safety for a Typical Canal Side Slope

	Dewatered Canal	Normal Operation
Water Level (feet, NGVD)	**0.0**	**10.0**
Slope		
2:1	72	127
3:1	72	127

The canal slope stability analysis results are detailed in **Table E11** in the **Appendix E**.

7.2.4 Global Slope Stability Analyses

Entire cross-section inclusive of canal side slope, bench and levee side slope was analyzed for global stability. The global stability analysis results for steady state seepage are detailed in **Table E12** in the **Appendix E**.

Factors of Safety for the Global Stability

Water Level (feet, NGVD)	13.5
Upstream	43
Downstream	43

7.3 Settlement Evaluation

The presence of peat across the project site requires an extensive study of the potential settlement of the levees where such materials are to be incorporated beneath levee sections. A parametric study for calculating the primary consolidation of peat was performed by varying the peat thickness, and levee height.

Limited testing was performed on the surficial muck of the proposed Cell 4 site. The testing was limited to moisture content and organic content. Laboratory consolidation test results of STA-2 falling within the range of the moisture and organic content test results of Cell 4 were utilized in our settlement evaluation.

Levee geometries presented in **Sheet 8** in the **Appendix F** were utilized in our evaluation. The used properties are provided below.

Void Ratio $\mathbf{e_o}$	4.68
Primary Compression Ratio $\mathbf{C_c}$	0.22
Coefficient of secondary compression $\mathbf{C_a}$	0.025
Coefficient of consolidation (square feet per day) **Cv**	2.0

Total settlement includes (1) elastic settlement of levee fill (2) primary consolidation of muck and (3) secondary consolidation of muck.

7.3.1 Elastic Settlement of Levee Fill

It is proposed in EM 1110-1-1904 to use 5 percent of the levee height to account for settlement due to it own weight and future traffic compaction. Due to the granular nature of the fill, the compression of this material should be a sole function of levee height and compaction effort and is not anticipated to be affected by the peat thickness. Our past experience indicates 5 percent is a reasonable estimate for compacted levee borrow material at the Cell 4 project site.

7.3.2 Primary Consolidation of Muck

Initially, we estimate that the loads induced by placement of levee fill will cause primary consolidation of the muck and elastic settlement of 1.3 and 1.5 feet for 2 and 3 feet muck thicknesses, respectively. This settlement is estimated to occur over a period of about one month from the placement of the fill. The table that follows presents a forecast of the estimated settlements that may occur due to primary consolidation of muck and elastic settlement of levee fill.

Muck Depth (feet)	End of Construction Levee Settlement* (feet)
1	1.0
2	1.3
3	1.5

* Elastic settlement of levee fill + primary consolidation of muck

7.3.3 Secondary Consolidation

After End of Construction, secondary compression will continue for the life of the levee, albeit at a diminished rate with time. The table below presents a forecast of the estimated settlements that may occur due to secondary compression of the muck.

Elapsed Time (years)	Estimated Total Settlement of the Muck (feet)	
	2 feet Muck Thickness	3 feet Muck Thickness
0.5	0.10	0.13
1	0.12	0.15
2	0.13	0.17
3	0.14	0.18
4	0.15	0.19
5	0.15	0.20
10	0.17	0.22
20	0.18	0.25
40	0.20	0.27

7.3.4 Additional Settlements

The final component of total settlements results from the additional fill overbuild on top of the design levee height. The required overbuild takes into account the sum of design levee height and anticipated settlements which comprise the levee fill to calculate total long-term secondary compression settlements.

Design charts were developed for estimating total settlements of the levees. Knowing the design levee height and peat thickness, total settlements of levees can be obtained from these charts. These charts are presented on **Sheet 8** in the **Appendix F**.

7.4 Erosion Protection

Most of the previous STA's erosion protection of the levee slopes was primarily achieved by dressing the side slopes of the levee with the borrowed muck along the canal excavation alignments followed by grass seeding. Based on discussions with SFWMD personnel during the workshop conducted during Cell 4 design, it was brought to our attention that the dressing of the side slopes with muck is not desirable because of the failure of muck slopes due to wave attack during major storm events.

A number of slope protection methods exist such as stone or sand-cement bag rip-rap, concrete paving, asphalt paving, rock-filled gabions, and soil-cement. The type of slope protection is predicated upon locally available materials and economic considerations.

For this project the appropriate methods for levee protection are stone riprap, soil cement, sand-cement bag and rock-filled gabions. Each method is described in the following sections.

7.4.1 Riprap

The use of riprap is a soil bioengineering practice to prevent erosion and stabilize slope. Riprap is designed taking the following into consideration: stability, bed degradation (altered run-off), depth and rock size.

Since the flow velocities are minimal, standard rubble riprap in accordance with section **530-2.2 Rubble** of the FDOT Standard Specifications for Road and Bridge Construction manual, is recommended for erosion protection.

Typically, riprap installation consists of the following steps:

- Placement Methods: The common methods of riprap placement are hand placing; machine placing, such as from a skip, dragline, or some form of bucket; and dumping from trucks and spreading by bulldozer. Hand placement produces

the best riprap revetment, but it is the most expensive method except when labor is unusually cheap. Steeper side slopes can be used with hand placed riprap than with other placing methods.

- Stone Placement: Rehandling or dragging operations to smooth the revetment surface tend to result in segregation and breakage of stone, and can result in a rough revetment surface. Stone should not be dropped from an excessive height as this may result in the same undesirable conditions. Riprap placement by dumping and spreading is the least desirable method as a large amount of segregation and breakage can occur.

7.4.2 Soil Cement

Design of the soil cement slope protection should follow the guidelines described in the EM 1110-2-1913 Design and Construction of Levees, dated September 30, 2000 and EM 1110-2-1911, Construction Control for Earth and Rock-Fill Dams, dated September 1995. The recommended method is to use plant-mixed rather than mixed-in-place soil cement.

- Inorganic soils should have a maximum size less than 2 inches, not more than 45 percent retained on the U.S. Standard No. 4 Sieve, and between 5 and 35 percent passing the U.S. Standard No. 200 Sieve.
- The soils should have a maximum plasticity index of 12 and not more than 2 percent (by weight) organic matter.
- Soils classified as GW-GM, GP-GM, GM-GC, SW-SM, SP-SM and SM-SC would be suitable.
- The soils should have a maximum plasticity index of 12 and not more than 2 percent (by weight) organic matter. Mix design for the soil-cement should be based upon laboratory tests that are completed at the onset of construction.
- The amount of cement and water added to the soil is based on laboratory tests to determine compaction properties.
- Plant-mixed soil cement is usually spread in 6-inch horizontal lifts along the slope in a strip, 10 feet wide and compacted by sheepsfoot or rubber-tired rollers.

7.4.3 Gabion Basket

Gabions are double twisted hexagonal woven galvanized steel wire mesh compartmented baskets with a rectangular box shape. The compartments or cells are of equal in size and dimension and are formed by internal diaphragms being placed within the basket. The compartments or cells are filled with natural stone and the diaphragms minimize stone migration within the basket providing even distribution of the stone fill throughout the basket even after structural movement. Gabion installation should be in accordance with **Section 531, Gabion Mattress** of the Turnpike Drainage Sample.

Gabion construction mainly consists of the bank slope or angle, bank preparation similar to the riprap alternative followed by placement of the gabion mattress as described below.

- Empty gabion baskets are assembled individually and placed on the approved surface to the lines and grades as shown or as directed, with the position of all creases and that the tops of all sides are level.

- Finished gabion structures should not have gaps along the perimeter of the contact surfaces between adjoining units. All adjoining empty gabion units are to be connected along the perimeter of their contact surfaces in order to obtain a monolithic structure. All lacing wire terminals are to be securely fastened.

7.4.4 Sand Cement Bags

The sand-cement riprap wall consist of bags of pre-packaged sand and cement which are pinned together with reinforcing bars to form a gravity type retaining wall.

Sand cement bag riprap in accordance with the FDOT Standard Specifications **530-2.1 Sand-Cement** for Road and Bridge Construction manual can be utilized for erosion protection.

Typically, sand cement bag installation consists of the following steps:

- The area to receive sand cement bags is thoroughly and completely cleared and cleaned of all vegetation and debris.
- Successive rows of bags are pinned one to the other with Number 4 reinforcing bars to provide a shear connection.
- The joints between rows of bags are staggered.

7.4.5 Recommendations for Erosion Protection of Levee Slopes

Considering that the levees are built with well graded mixture of sand, gravel, cobbles and boulders, we do not envision erosion protection of levee slope as a necessary requirement for this project. However, for erosion protection around water control structures we recommend limestone rubble riprap.

7.5 Seepage Evaluation

Seepage analyses were completed to estimate potential seepage losses from Cell 4 and to provide input to the design team related to the implications of such seepage.

7.5.1 Boundary Conditions

The land within the area proposed for Cell 4 has historically been utilized for farming operations. Based upon information provided by the project surveyor, we understand the ground surface elevation across Cell 4 averages approximately +8.5 feet with respect to the National Geodetic Vertical Datum of 1929 (NGVD). Target water depths for Cell 4 are 1.25 to 1.5 feet, resulting in an average target water surface elevation of about +10 feet NGVD. For the design flows, the water surface elevation in Cell 4 is expected to be approximately +13 feet NGVD.

Maintained surface water levels in the existing STA-2 seepage collection canal are reported to be +7.5 to +8.5 feet NGVD. We understand that the proposed Cell 4 discharge canal will be maintained at a somewhat higher (i.e. +9.5 to +11.0 feet NGVD) elevation than is the existing seepage collection canal. The existing North New River Canal, which bounds the proposed Cell 4 footprint on its western side, has historical high and low stages of +12.6 and +7.8 feet NGVD, respectively, for the time period between 1985 and 2004 (reference: SFWMD DBHYDRO).

An approximately 33-acre pond is located near the southwest corner of the proposed Cell 4 footprint. The pond has bottom elevations in the range of -15 to -20 feet NGVD. Reportedly, the pond has been utilized for fish farming operations at various times in the past.

7.5.2 Typical Section

Based upon information provided to us by the project design team, we understand that the perimeter levees will have a crest width of 14 feet and a crest elevation of +19 feet NGVD. The levees will have a design side slope of 3:1 (horizontal: vertical). A 20-foot wide bench will be constructed between the toe of the levee and the top of bank of the adjacent inflow and/or seepage collection canal. A bench width of 70 feet is planned for the north perimeter between the exterior levee and the seepage collection canal. Excavations for the canals will generally bottom between elevations 0 and -5 feet NGVD. Canal cut side slopes are designed to be 2:1 to 2.5:1 (horizontal: vertical).

Based upon review of the existing STA-2 canal cross-section as-builts, the existing canal side slopes generally average 1:1. Seepage analyses completed for this study assumed canal side slopes of 1:1 and 2:1.

7.5.3 Seepage History

The US Army Corps of Engineers (USACE) has estimated and documented seepage for the Everglades Agricultural Area (EAA), inclusive of STA-2, in the 1940's and 1950's.

The USACE provided a normalized seepage rate in terms of cubic feet per second per foot of head per mile of perimeter levee (cfs PFHML). Design of the existing STA-2 project was based upon an assumed perimeter seepage rate in the range of 3 to 4 cfs PFHML, as discussed in Amendment No. 1, Task 2-5, Seepage & Groundwater Interaction, April 29, 1996. During the initial filling of STA-2 in October 1999, the SFWMD construction oversight staff implemented a hydraulic load test on a 4-mile reach of the inflow canal. The load test was completed using calibrated pumping rates and steady state hydraulic heads in the inflow canal and in the seepage canal. The calculated seepage was 3.7 cfs PFHML.

7.5.4 Seepage Evaluation

The typical section variables of bench width, upstream canal geometry, downstream seepage collection canal geometry, pool levels and seepage canal water surface elevations were utilized as input to a parametric evaluation in order to check the sensitivity of each variable on the resulting seepage quantities.

The boundary conditions (i.e. crest width and height, embankment side slopes, pool elevation and seepage canal elevation, and canal geometries) were used as input to an estimate of seepage utilizing the computer program SEEP2D (GMS Model 4.0). SEEP2D is a two-dimensional finite element, steady state flow model that was developed by Fred Tracy of the U.S. Army Engineer Waterways Experiment Station in Vicksburg, Mississippi. The proposed perimeter levee was assumed to be a homogeneous embankment constructed of materials excavated from adjacent canal cuts. The excavations will require the aid of blasting owing to the hardness of the limestone caprock which underlies the site at relatively shallow depths. The resulting materials should consist of a mixture of sand and gravel with silt, cobbles and boulders. We assumed the following permeability (k) values for the various embankment and subsurface profile components:

- Embankment Materials, k = 20 feet per day
- Peat, k = 10 feet per day
- Limestone, k = 50 feet per day
- Sand and gravel with limestone lenses and layers, k = 100 feet per day

The depth of the upstream canal and bench width (defined as the distance between the levee toe of slope and canal's top of bank) were varied. Depths of cut were assumed to be 10, 15 and 20 feet, while the bench widths were set at 20, 50 and 100 feet. Similar variations were made for the seepage collection canal. The effects of the upstream borrow and/or inflow canal geometry and the geometry of the seepage collection canal are presented in the following tables.

EFFECTS OF UPSTREAM (BORROW) CANAL GEOMETRY			
Distance From Upstream Toe (feet)	**Unit Rate of Seepage (cfs PFHML)**		
	Borrow Canal Depth (feet)		
	10 Feet	**15 Feet**	**20 Feet**
20	3.01	3.07	3.13
50	2.96	3.00	3.04
100	2.93	2.95	2.97

Note: Assumes seepage canal is 10 feet deep, downstream bench is 20 feet wide, pool elevation is +13 feet NGVD, seepage collection canal water elevation is +7.5 feet NGVD and canal side slopes are 1:1.

EFFECTS OF SEEPAGE CANAL GEOMETRY			
Distance From Downstream Toe (feet)	**Unit Rate of Seepage (cfs PFHML)**		
	Seepage Canal Depth (feet)		
	10 Feet	**15 Feet**	**20 Feet**
20	3.02	3.29	3.50
50	2.85	3.09	3.27
100	2.52	2.71	2.85

Note: Assumes borrow canal is 10 feet deep, bench is 20 feet wide, pool elevation is +13 feet NGVD, seepage collection canal water elevation is +7.5 feet NGVD and canal side slopes are 1:1.

Generally speaking, the results of the analysis indicate that the seepage rates increase for increased borrow and/or inflow canal depths, but decrease with increasing upstream bench width. Similarly, seepage rates increase for increased depth of the seepage collection canal and decrease for increasing downstream bench width. Assuming upstream and downstream water surface elevations of +13 and +7.5 feet NGVD, respectively, upstream and downstream canal depths of 10 feet, and canal side slopes of 1:1, the calculated seepage rates range between approximately 2.5 and 3.5 cfs PFHML.

Further, the pool water surface elevation and seepage canal water surface elevation were varied to evaluate the effects of these variables on the rate of seepage. Assumptions for this analysis include upstream and downstream canal depths of 20 feet, upstream and downstream canal bench widths of 20 feet, and canal slopes of 1:1. These relationships are presented in the table that follows.

EFFECTS OF POOL ELEVATION			
Pool Elevation (feet)	**Unit Rate of Seepage (cfs PFHML)**		
	Seepage Canal Water Surface Elevation (feet)		
	+7.5	**+9.5**	**+11.0**
+13	3.66	3.69	3.71
+12	3.63	3.66	3.68
+11	3.60	3.63	NA
+10	3.58	3.59	NA

Note: Assumes upstream and downstream canals are 20 feet deep, upstream and downstream benches are 20 feet wide and canal side slopes are 1:1.

Review of the information presented in the table indicates that the unit rates of seepage vary between approximately 3.6 and 3.7 cfs PFHML, which compares favorably with the value estimated during the initial filling of STA-2. Typical SEEP2D generated flownets for the conditions described in the table above are presented on **Sheets F1 through F10** in **Appendix F**.

The flownets also indicate that the top flow line exits the embankment slope at some distance above the exterior toe of the embankment slope. Since this condition is not desirable for the long-term performance and maintenance of the levees, we recommend that the downstream bench be raised two feet above the natural ground surface elevation. The materials used to construct the downstream bench raise should consist of embankment materials and should be placed without benefit of vibratory roller compaction. Seepage exit gradients are predicted to be acceptable from the standpoint of piping potential for pool elevations up to +13 feet NGVD.

Final SEEP2D computer runs were made for conditions that include an upstream canal that has 2:1 (horizontal: vertical) side slopes, a canal bottom width of 14 feet, and a canal bottom elevation of –5.5 feet NGVD. The upstream bench width was assumed to be 20 feet. The seepage canal was given a bottom width of 5 feet, a bottom elevation of +0.5 feet NGVD, and 2:1 side slopes. The downstream bench width was set at 70 feet, all to replicate the anticipated design conditions along the north perimeter of Cell 4. Pool elevations were varied between +10 and +15 feet NGVD, and the seepage canal water surface elevation was assumed to be +8.5 feet NGVD. Results of this analysis are presented in the following table.

Pool Elevation (feet - NGVD)	**Seepage (cfs/mile)**	**Unit Rate of Seepage (cfs PFHML)**	**Exit Gradient**	**Factor of Safety For Piping**
+15	21.52	3.31	0.45	2.2
+13	14.63	3.25	0.30	3.3
+12	11.31	3.23	0.24	4.1

Pool Elevation (feet - NGVD)	Seepage (cfs/mile)	Unit Rate of Seepage (cfs PFHML)	Exit Gradient	Factor of Safety For Piping
+11	8.00	3.20	0.16	6.1
+10	4.76	3.17	0.10	10.2

Flow nets for these conditions are shown on **Sheets F11 through F15** in **Appendix F**. It should be noted that the exit gradient for the condition with the pool elevation at +15 feet NGVD results in a factor of safety of 2.2. For sands, the factor of safety against piping is normally specified at 3 or greater. Considering that the embankment materials will consist of sand and gravel, the factor of safety against piping is estimated to be 2.6 with the STA at elevation +15 feet NGVD. Based upon the short term duration for this loading condition, we believe the factor of safety for piping is acceptable. Further, the lands between the downstream toe of the perimeter dam and the seepage canal will likely be wet as a result of mounded groundwater table conditions associated with seepage.

7.5.5 Fish Pond

The presence of the existing borrow lake (the fish pond) located near the southwest corner of Cell 4 and its effects on seepage losses was evaluated using groundwater modeling. The computer program utilized for this analysis was MODFLOW, "A Modular Three-Dimensional Finite Difference Ground Water Flow Model" by the USGS (McDonald & Harbaugh), 1984 to calculate saturated infiltration.

The MODFLOW analyses utilized the aquifer parameters that are presented in the following table.

Parameter	Layer			
	1	2	3	4
Top of Aquifer (feet-NGVD)	NA	8	6	-8
Bottom of Aquifer (feet-NGVD)	8	6	-8	-200
Permeability (feet/day) Permeability (pond & ditch)	10 1000	10 10	50 50	100 100
Storage (factor) Storage (pond)	0.15 1	0.15 0.15	0.001 0.001	0.0001 0.0001
Leakance (day^{-1}) Leakance (fish pond & ditch)	0.067 1	0.0417 0	0.322 0.322	NA NA

The analysis was initially completed for a 10-day duration with the water surface elevation in Cell 4 at +13 feet NGVD. The model was set up with boundary conditions similar to those described earlier. The model was run for the existing condition (with the fish pond) and for a theoretical condition where the fish pond was not present. A comparison was made between the model results for conditions with and without the fish pond. The analysis was also completed for a 90-day period with the water surface elevation in Cell 4 at +10 feet NGVD. The model was again run for the conditions including and not including the fish pond. The values for leakance for layers 1 through 3, and the permeability for layer 4 were adjusted (increased) until the total flow was predicted to be similar to that forecasted using the assumed boundary conditions and a unit rate of seepage of 3.5 cfs PFHML that was obtained from the SEEP2D evaluation. Results of the analyses are presented in the following table.

Time (days)	Water Level in Pond (feet-NGVD)	Flow Without Fish Pond (CFD)	Flow With Fish Pond (CFD)
10	13	5,321,642	5,324,786
90	10	2,127,156	2,131,005

As evidenced by the results presented in the table above, the presence of the fish pond results in less than 1 percent increase in seepage quantities when compared with the condition where no fish pond is present. Considering the size of the project, it is our opinion that this magnitude of increase is not significant and does not warrant special design requirements, their depth of occurrence and magnitude of such loss.

This conclusion is based in part after review of drilling logs that did not indicate drill fluid circulation losses anywhere within the depth of exploration (i.e. 50 feet deep). We recommend additional exploratory borings be drilled adjacent to the fish pond and to a depth of 100 feet. The borings should be carefully monitored for drilling fluid circulation losses. A revised MODFLOW analysis should then be completed to provide model refinements based upon the results of the additional SPT borings.

7.6 Blasting

Blasting of hard caprock materials to excavate for canals and to produce fill materials has been a significant part of the construction of the previous STAs within the EAA. Based on our experience with the carbonate rock material (e.g. limestone) encountered and experience obtained from the construction of STA-2, the material will require blasting to facilitate economical construction if the material exhibits either of the following properties:

- SPT N-Values greater than 25 blows per foot.
- Coring rates of less than 1 foot per minute with a downward drilling pressure

ranging from 400 to 500 psi is maintained.

The subsurface exploration of this site reveals conditions similar to other STAs in the EAA and therefore, it is anticipated that Cell 4 construction will include significant amounts of blasting to facilitate excavations for canals.

The previous work generated a large quantity of data concerning blasting operations in this area. Most of this data is in the form of experience and observations of the individuals and companies involved in the previous operations. To tap this predominately unrecorded knowledge, a design workshop was conducted during STA-3/4 where individuals of many different companies and points of view met to discuss the important issues and lessons learned in the previous blasting operations.

The discussion included points and topics which were determined through trial and error and observation during previous STA's construction. Included in these were the following:

- Blasting should be designed to help prevent overbreak as much as is practical to help limit under seepage beneath the levees. Apparently this has been a problem with levees adjacent to blasted canals in STA-2.
- The basic goal for all levees is to minimize seepage. The strata 2A & 2B mix is good if the over 18 to 20 inches size is limited to less than about 20% by weight. A finer and more uniform gradation will be required in the levee to provide strength, uniformity, and seepage control.
- The maximum rock or particle size used in levee construction was 24 inches. Experience shows that the majority of this size material came from the top of the blasted rock formation. This is apparently due to the lack of confinement of this material. Due to this, most of the oversize ended up in the bottom of the levee.
- Since the oversized materials come from areas where open faces are present, the widening of canals presents a greater opportunity to produce oversize than blasting in undisturbed areas.
- Another observation was that most of the over size came from areas where slopes were being blasted in cap rock. These areas present shallow blasting with little confinement, which results in the predisposition towards large resulting rock sizes.
- Deepening of shot holes in slope areas had little effect on oversize production and appeared to increase the over break.
- Flyrock was also a problem where structures and power lines were nearby.
- The flooding of blast pattern areas with 4 to 5 feet of water reduced the flyrock problem to a manageable level.
- Angle drilling of shot holes to direct flyrock did not work well.
- Experience shows that smaller shot holes and closer patterns tend to produce less flyrock and a better resulting grain size.
- Variation in shot materials has not been effective in controlling flyrock or grain

size but accurate shot timing can be effective.

- Seepage has been a problem in the bottom of canals so control of overbreak is very important to the future project operation.
- The single most significant variable is the rock material being shot.
- The data presented in previous geotechnical reports was more than adequate. No additional data was suggested that could help provide better or additional data for blasting design.
- Specifications for the project should include a provision for test shots and/or test sections.
- Designing slopes in canals as steep as possible helps in the blasting operation by providing less flyrock and the ability to better control grain size.
- Fracturing of areas between parallel canals was not a particular problem beyond the problem already stated about overbreak.
- Thorough inspection of structures near the blasting zone should be provided before and after blasting to help control possible damage claims.

In summary the results of the workshop regarding blasting include the following comments:

- For future STAs, designs should include consideration of steep side slopes for blasted canals to assist in the construction control of flyrock and maximum grain size. This should not, of course, be the only consideration as hydraulic capacity, safety, and other factors enter into the design and may control the final cross section.
- Overbreak is a major issue that the blasting contractor needs to control to help control seepage in the finished project.
- Methodologies have been developed to control flyrock to a reasonable degree.
- The provided geotechnical data in this report, which emulates the data provided in previous reports, should be sufficient for guidance in blasting design.
- Nesting of oversize is generally related to material coming from the top of the blasted zone.
- Nesting can be most easily controlled by special attention to maximum particle size, mixing of blasted materials and care and inspection of the placement operations during levee construction.
- The project specifications should include pre and post blasting inspections provided by the contractor to help control possible damage claims.
- The specifications should include indemnification of the owner by the contractor for any and all blasting damage.

7.7 Excavations

All excavations should strictly follow all provisions of the current OSHA regulations for minimum slopes and other requirements for construction beneath the ground. If minimum slopes cannot be maintained then retention systems should be provided to properly protect personnel working within the excavation. All such retention systems should be designed, signed and sealed by an engineer qualified to design such systems.

Based on current experience, the excavation of the caprock (Stratum 2A) will likely require explosives. After this caprock has been removed, it is anticipated that the remainder of the excavation, which could encounter any of the sand and limestone seams (Stratum 2B) and sand (Stratum 3) can likely be performed with conventional equipment. This will provide better depth and lateral control of the excavation and should not shear the adjacent rock surfaces that do not require removal. Hoe mounted hydraulic breaking equipment and/or larger hoes with high breakout capacity should work well for limestone layers encountered within Stratum 3. However, it is also possible that harder limestone layers which may be more economically removed by blasting may also occur in these strata. Extra care should be exercised when excavating in this zone and care should be taken to minimize over break in all areas.

Blasting of the caprock will likely result in flyrock which can produce adverse impacts on public access along the North New River Canal levee and STA-2 levee along the eastern boundary of Cell 4. Constructability reviews with various earthwork contractors, experienced with similar construction in the area, indicates that flyrock can be considerably controlled by the following:

- Blasting performed with 3 to 5 feet of water surcharge over the blasting area.
- Canal side slopes designed to be closer to vertical than gradually sloped.

Although the borings performed for this project did not encounter evidence of cavities or voids, these features are common in the limestone underlying most of Florida. In the event that such a cavity or void is encountered in the area, its backfilling and remediation to allow construction will need to be handled on a case by case basis. Remediation techniques will vary widely based on the location and size of the feature. If such a feature is encountered during construction, RADISE should be notified to provide additional construction recommendations.

7.8 Utilization of Excavated Materials

In the process of earthmoving there may be a reduction of the volume (“shrinkage”) because of waste and densification, or an increase of volume (“swell”) because of the presence of hard rock. This volume change is due to the difference between the final density (levee) and the original density (in-situ material).

In the process of excavation and earthmoving a reduction of the volume of soils and rock is anticipated. Strata 2A and 2B will be blended before placement, blasting produces some amount of flyrock, and other volumetric losses are expected. Therefore, a minor shrinkage of 5% is recommended for these strata for the design of the proposed construction.

7.9 Foundations for Water Control Outflow Structures

We do not have any information regarding the inflow/outflow structures for the supply and distribution of storm water to the treatment cell. We will incorporate our recommendation regarding structures in our report for final design.

7.10 North New River Canal Levee

To support utilization of the North New River Canal levee as the western containment levee for the proposed Cell 4, RADISE performed geotechnical exploration:

- To obtain information regarding subsurface materials along the existing levee alignment and
- To provide subsurface data necessary for geotechnical analysis and design.

Results of this exploration are presented in a separate submittal.

8.0 CONSTRUCTION RECOMMENDATIONS

This section provides general recommendations for the construction of the levees and canal sections including recommendations for general site preparation, excavation, and dewatering.

Construction of the proposed levee and canal system requires that the contractor recognize the nature of the proposed construction, site access constraints, limiting ground conditions, and operational characteristics of the proposed system. Effective utilization of existing on-site borrow fills from canal excavations is required to balance fill/excavation quantities and to minimize earthwork construction costs.

8.1 Site Access and Work Surface Preparation

Access to the site, preparation of work surfaces to receive fill, fill placement, and equipment mobility in proposed canal and borrow excavation areas will present major considerations to the earthworks contractor. Access to and within the site will be restricted due to the remote nature of the site and the difficult surface conditions prevalent in the project area.

The presence of the surface peats in thicknesses varying from 1 to 4 ft will pose problems to the movement of heavy draglines, bulldozers, compactors, and other construction equipment around the project site. Additionally, the generally high groundwater levels will further complicate site access particularly during the wet season and after significant rainfall events.

8.1.1 Site Access

General access to the project will likely be regulated from the west via bridges across the North New River Canal from SR 27 as well as from the western boundary of Cell 3 of STA-2.

The earthworks contractor must plan their construction activities to accommodate these access restrictions and must include within his bid, necessary temporary roadway to facilitate his work and internal site access. Such temporary roads may require geotextile fabrics be placed beneath roadway fill in peat areas exceeding 3 ft in thickness in order to support access by heavy equipment.

8.1.2 Site Preparation

Site preparation activities will include preparation of levee and canal alignment areas and the potential construction of limited necessary temporary access roadways to and from work areas. Levee and canal alignment preparation shall include the clearing,

without grubbing, of existing brush and low vegetation. Stands of dense vegetation such as Brazilian Pepper will require clearing by cutting at the ground surface.

The limbs should be removed and disposed of by burning. It is desirable to attempt to leave brush and low vegetation and the root system from such vegetation in place as these materials will act to stabilize the surface peats. Limited clearing at existing property lines and intermittent infilling of dewatering canals will be required in these areas.

In levee alignments, where peat thicknesses exceed 3 it, it is recommended that a layer of uniaxial geogrid, (Tensar BX 1100, for example) be laid beneath the levee section. The geogrid may be laid directly over the existing peats. Alternatively a layer of leveling fill can be spread across the peats prior to application of the geogrid. However, experience gained though construction of STA-2 indicates that geogrid reinforcement is not required provided the peat is pre-drained or pre-consolidated.

In interior cell areas it will be necessary to locally fill some existing farm ditches to mitigate direct flow conduits through the cell. Infilling requirements for these ditches will be dictated by cell flow dynamics and are beyond the scope of this study.

However, it is anticipated that such canals can be unfilled with loose limestone fill trucked in place and then covered with a thin layer of peat to facilitate wetland type vegetation growth.

8.1.3 Levee Construction

Levee construction over the existing peats will reduce construction costs by eliminating the need to excavate and replace these materials. Construction of the proposed levee can be accommodated over the existing compressible peats so long as the designs recognize their short and long term consolidation characteristics. We estimate that the peat will settle up to 30 percent during and after construction. Somewhat less settlement can be expected in areas where organic soils have been partially pre-consolidated by the existing levee.

Constructability reviews with various earthwork contractors experienced with similar construction in the area, indicates that borrow/canal areas can be effective/economically drilled and blasted. Peat thicknesses greater than approximately 3 feet have created more access problems to both drilling and blasting equipment, excavation equipment and the construction costs of working on such thicknesses increase significantly. Also, the presence of surficial boulders can also create access and possible additional flyrock problems.

8.1.3.1 Levee Placement Requirements

Placement of fill material should be placed in a manner described below.

- The levee fill material is to consist of onsite soils obtained from the blasting of canal excavations. Blasting area should be completely free from the surficial muck layer.

- The maximum particle size should be 12 in, although up to 10 percent of over-sized material (between 12 and 24 inches in diameter) could be allowed. Care should be exercised in placing the oversized materials to assure that nesting does not occur and to further assure that the oversize particles are fully surrounded by finer grained materials. Nesting of the layer oversize materials is not desirable since it can lead to voids incorporated in the fill and to piping failure of the levee.

- Material from the canal excavation is expected to have a high moisture content, and should be allowed to drain for a period sufficient to obtain a suitable moisture content for placement and compaction prior to final incorporation in the levee embankment. A suggested suitable moisture content for final placement is $\pm$ 3 percent of the soils optimum moisture content as determined from the soil's modified Proctor compaction test (ASTM D 1557).

- All soils placed over (if any) existing berms should be tested to their full depth by a qualified engineering technician working under the direction of the geotechnical engineer to verify it’s density.

- First fill lift over the existing muck should be placed in layers not exceeding 36 inches in loose thickness and then after each fill lift should be not exceeding 24 inches in loose thickness. Each fill layer should be properly compacted to at least 95 percent of the maximum modified Proctor dry density as indicated by ASTM D-1557.

- The surface of each lift should be made level to allow for relative density testing and scarified prior to the placement of the next vertical lift.

- Vibratory rollers should be suitable for compaction of these soils depending on their moisture content. The haulage equipment should also be suitable for compacting the fill as long as the minimum compaction requirements are reasonably obtained.

- The material used to raise the downstream bench of 2 feet should be more permeable than the embankment. This is to avoid raising the phreatic surface in the embankment. This can be accomplished by utilizing embankment materials

placed without benefit of vibratory roller compaction in the bench area.

- A minimum recommended test frequency of one test per 1000 lineal feet for each lift is recommended. The depth of tests should be varied within an individual lift to help assure the full lift depth has been properly compacted.

- Primary settlement is estimated to occur over a period of about one month from the placement of the fill. The final component of total settlements results from the additional fill overbuild on top of the design levee height. The required overbuild takes into account the sum of design levee height and anticipated settlements which comprise the levee fill.

- After that primary settlement, secondary compression will continue for the life of the facility, albeit at a diminished rate with time. The settlement over time may cause some areas to be slightly lower than others.

8.1.3.2 Settlement Plates

Prior to construction, it is recommended that a test levee section be constructed which demonstrates the constructability of the proposed levee design. The intent of the test section will be to define optimum construction procedure which will expedite levee construction to the fullest extent possible while meeting the requirements of the design. The test section should be instrumented with settlement plates and extensive survey controls provided to evaluate measured settlements and bulking/shrinkage of the borrow materials. The test section should be constructed over a 300 ft length and will be used to establish a basis for all subcontract bids for the earthwork.

Since limited testing was performed on the muck, we recommend additional settlement plates along the perimeter and exterior levee alignment of the inflow canal.

8.1.3.3 Dewatering

Excavations will be required for seepage collection canals, borrow areas, and pump structure construction. Excavations into the insitu limestone will require blasting to fracture the cemented limestone structure to allow for excavation by draglines or backhoe equipment. Excavations through the surface peats will require that cut slopes be excavated to 1 to 1 (horizontal to vertical) or flatter slopes in non-agricultural areas to prevent sloughing of the peats into the excavation.

Due to the high groundwater level, dewatering may be required for excavations more than a couple of feet below the ground surface. Excavations for seepage collection canals and borrow areas may be completed in the wet without dewatering or the contractor may attempt to dewater with large surface stationed pumps. Due to the high transmissivity and jointed nature of the insitu limestone, groundwater flows to the

excavation will be significant and would likely preclude effective dewatering of significant sections of canal and excavations greater than one-half mile. Fill material excavated in a wet condition, will be required to be stockpiled and drained prior to spreading and compaction of the fill.

9.0 LIMITATIONS

RADISE International warrants that the field and laboratory services performed, recommendations and professional advice presented in this report are based upon recognized principles and practices in the discipline of geotechnical engineering and hydrogeology. No other warranties are expressed or implied.

The scope of this study was intended to evaluate geotechnical considerations with respect to, levee and canal slope stability, seepage, settlement and erosion for design elements of Cell 4 as part of the Stormwater Treatment Area 2 (STA-2) expansion project in Palm Beach County, Florida.

Due to availability of geotechnical data from nearby projects, schedule and other constraints, RADISE was directed to use some of the geotechnical design parameters (muck strata and levee material) and perform analyses based on the data from the Geotechnical Reports made available by the District. Analyses and recommendations submitted in this report are partially based on this data. It is understood that this data is not the responsibility of RADISE. RADISE does not warranty the accuracy of the methods or the data in these reports.

Our sub-consultant, Dunkelberger Engineering & Testing, Inc. completed the seepage evaluation and provided input, text and graphics related to seepage.

In the initial stages of the project it was decided that muck will be removed along the levee alignments. Therefore, limited testing was performed on the surficial muck. The following laboratory tests on muck were not within the scope of work and therefore not performed.

- Strength Tests
- Consolidation (compressibility) Tests
- Permeability Tests

The project surveyor WSM provided us with the ground surface elevations at the boring locations. All the boring elevation and other survey information incorporated into this report from our Work Order # 3 submittal are in NAVD 88. Remaining sections of the report performed as part of Work Order # 4 are presented in NGVD 29.

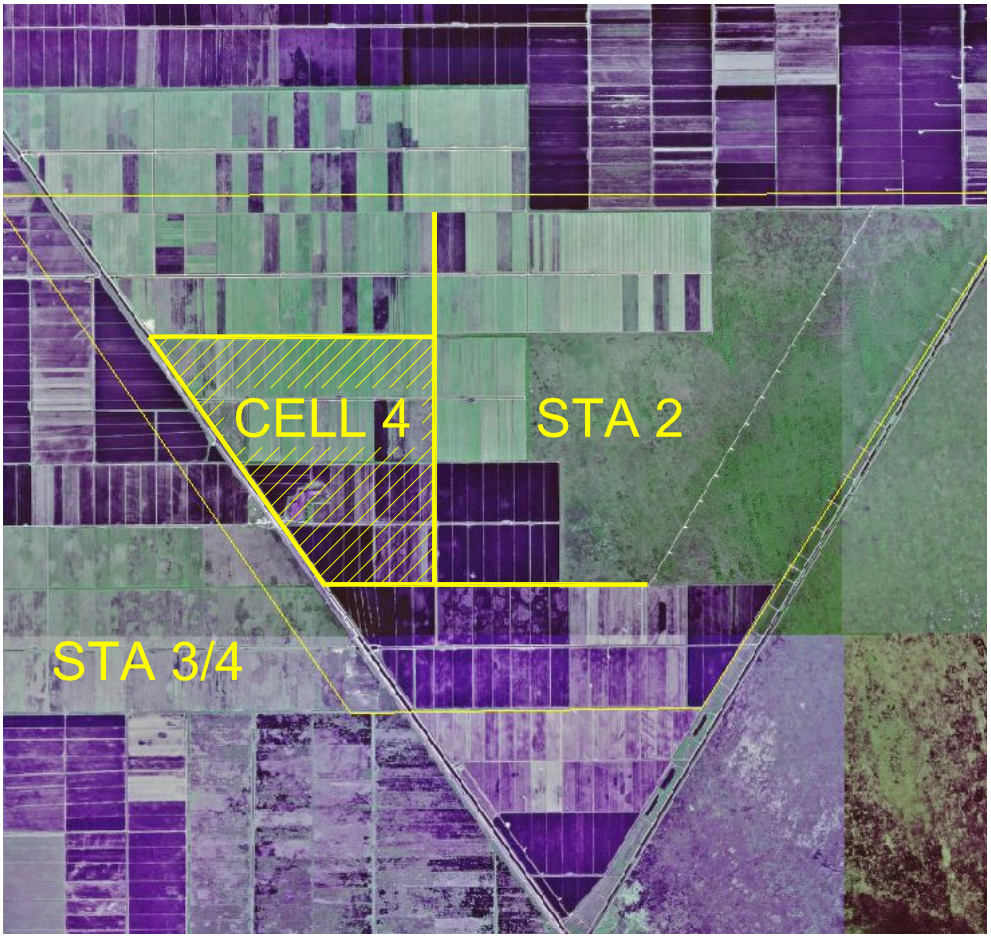
If design sections vary from those assumed for this evaluation, we should be notified and given opportunity to review such conditions in light of the conclusions of this report. We respectfully request the opportunity to review and comment on the project's drawings and specifications that pertain to structure foundations and other geotechnical aspects of the work once they are finalized.

10.0 REFERENCES

Following is a summary of organizations with codes and standards referenced for this report.

- American Society for Testing and Materials (ASTM) for soil and rock testing
- Florida Department of Transportation (FDOT) for Soil and Foundation Hand Book 2004
- South Florida Water Management District (SFWMD) Permit Manual IV
- Federal Highway Administration (FHWA), Publication No. NGHI-00-0045 "Soil and Foundation Workshop"
- United States Department of the Army Corp of Engineers
    - EM 1110-2-2300, General Design and Construction Considerations for Earth and Rock-Fill Dams
    - EM 1110-2-1902, Slope Stability
    - EM 1110-2-1908, Instrumentation of Embankment Dams and Levees
    - EM 1110-2-1911, Construction Control for Earth and Rock-Fill Dams
    - EM 1110-2-1913, Design and Construction of Levees
    - EM 1110-2-4000, Engineering and Design, Sedimentation Investigations of Rivers and Reservoirs
    - EM 1110-2-1420, Hydrologic Engineering Requirements For Reservoirs
    - EM 1110-2-1601, Engineering and Design - Hydraulic Design of Flood Control Channels
- Fundamentals of Geotechnical Analysis, I.S. Dunn, Loren R. Anderson and F.W. Keifer, John Wiley and Sons, 1980
- Soil Mechanics, Lambe and Whitman.

APPENDIX A



8000 0 8000 16000 Feet

Range 38E, Township 46S, Sections 31, 32 and 33
Range 38E, Township 47S, Sections 5 and 6

CELL 4 LAYOUT STA 2/CELL 4 EXPANSION PROJECT PALM BEACH COUNTY, FLORIDA				PROJ. NO. 04/RB/GEOT/0701	
RADISE International 4152 West Blue Heron Boulevard Suite 116 Riviera Beach, Florida 33404 TEL 561-841-0103 FAX 561-841-0104 URL:http://www.radise.net	RADISE Infrastructure Engineers & Software Developers	DRAWN EA	CHECKED V V	DATE 04/25/05	SCALE 1" = 8000'
		APPROVED KAA	REVISED 04/25/05		SHEET 1

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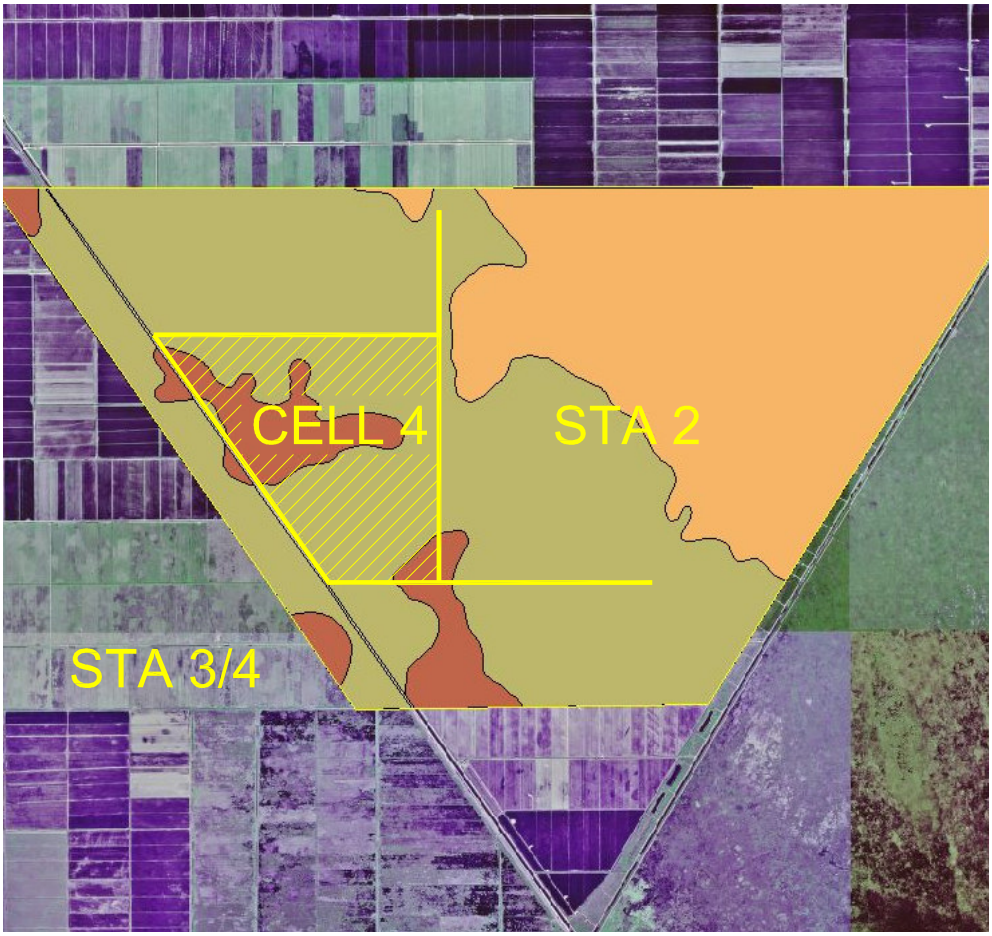

8000 0 8000 16000 Feet

LEGEND

- LAUDERHILL MUCK
- PAHOKEE MUCK
- TERRA CEIA MUCK

SOURCE: U.S.D.A. - S.C.S., Pg. Nos. 135, 147
SOIL SURVEY FOR PALM BEACH COUNTY AREA, FLORIDA
ISSUED: 1978

CELL 4 USDA SOILS MAP STA 2/CELL 4 EXPANSION PROJECT PALM BEACH COUNTY, FLORIDA				PROJ. NO. 04/RB/GEOT/0701	
RADISE International 4152 West Blue Heron Boulevard Suite 116 Riviera Beach, Florida 33404 TEL 561-841-0103 FAX 561-841-0104 URL:http://www.radise.net	RADISE Infrastructure Engineers & Software Developers	DRAWN EA	CHECKED V V	DATE 04/25/05	SCALE 1" = 8000'
		APPROVED KAA	REVISED 04/25/05		SHEET 2

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APPENDIX B

TABLE B1

ALONG c1-c**						
Muck Probe No.	**Latitude**	**Longitude**	**Northing (Y Co-ordinate)**	**Easting (X Co-ordinate)**	**Surface Water Height (inches)**	**Muck Depth (inches)**
MP1	26.4218	80.5447	759266	805184	0	24
MP2	26.4218	80.5549	759244	801847	0	24
MP3	26.4218	80.5519	759248	802811	0	36
Average Values					0	28

**: RADISE field indicators; see Sheets 3A through 3E in the Appendix B

TABLE B2

ALONG c1-e**						
Muck Probe No.	**Latitude**	**Longitude**	**Northing (Y Co-Ordinate)**	**Easting (X Co-ordinate)**	**Surface Water Height (inches)**	**Muck Depth (inches)**
MP4	26.4205	80.5559	758789	801504	0	26
MP5	26.4162	80.5559	757224	801518	0	6
MP6	26.4127	80.5559	755942	801522	0	48 +
MP7	26.4108	80.5559	755265	801525	0	20
MP8	26.4098	80.5559	754902	801526	0	0
MP9	26.4098	80.5559	754902	801526	0	6
MP10	26.4082	80.5559	754316	801528	0	25
MP11	26.4068	80.5563	753811	801412	0	19
Average Values					0	14.6

**: RADISE field indicators; see Sheets 3A through 3E in the Appendix B

TABLE B3

ALONG E-e**						
Muck Probe No.	**Latitude**	**Longitude**	**Northing (Y Co-Ordinate)**	**Easting (X Co-ordinate)**	**Surface Water Height (inches)**	**Muck Depth (inches)**
MP12	26.4063	80.5807	753602	793402	0	8
MP13	26.4061	80.5846	753517	792120	6	13
MP14	26.4061	80.5765	753526	794784	0	7
MP15	26.406	80.5879	753484	791057	6	8
MP16	26.4057	80.5724	753379	796112	6	8
MP17	26.4053	80.5682	753252	797513	6	10
MP18	26.4049	80.5582	753122	800768	6	19
MP19	26.4046	80.5559	753013	801514	0	9
MP20	26.4046	80.5598	752989	800269	6	22
Average Values					8.5	10.3

**: RADISE field indicators; see Sheets 3A through 3E in the Appendix B

TABLE B4

ALONG F-f**						
Muck Probe No.	**Latitude**	**Longitude**	**Northing (Y Co-Ordinate)**	**Easting (X Co-ordinate)**	**Surface Water Height (inches)**	**Muck Depth (inches)**
MP21	26.4003	80.5627	751441	799301	12	8
MP22	26.4003	80.5581	751446	800829	6	16
MP23	26.4002	80.5727	751369	796046	0	18
MP24	26.4001	80.5857	751315	791773	0	18
MP25	26.4	80.5827	751308	792773	0	18
MP26	26.4	80.5827	751298	792764	0	12
MP27	26.3999	80.5727	751258	796028	0	24
MP28	26.3995	80.5633	751147	799120	0	9
MP29	26.3994	80.5794	751100	793838	12	13
MP30	26.3994	80.5748	751105	795365	12	20
MP31	26.3993	80.5673	751062	797802	12	13
MP32	26.3991	80.5559	751014	801521	NR	0
MP33	26.3991	80.5607	750999	799966	0	18
MP34	26.3974	80.5587	750365	800614	0	12
Average Values					3.2	14.2

**: RADISE field indicators; see Sheets 3A through 3E in the Appendix B
NR: Depth of surface water was not recorded

TABLE B5

ALONG G-g**						
Muck Probe No.	**Latitude**	**Longitude**	**Northing (Y Co-Ordinate)**	**Easting (X Co-ordinate)**	**Surface Water Height (inches)**	**Muck Depth (inches)**
MP35	26.3946	80.5595	749375	800354	0	31
MP36	26.3946	80.5575	749367	801027	6	3
MP37	26.3944	80.556	749298	801518	0	22
MP38	26.3932	80.5599	748849	800247	0	9
MP39	26.3931	80.5775	748810	794463	6	6
MP40	26.393	80.5657	748782	798346	12	19
MP41	26.3929	80.5633	748744	799138	6	6
MP42	26.3928	80.5736	748703	795755	6	29
Average Values					4.5	15.6

**: RADISE field indicators; see Sheets 3A through 3E in the Appendix B

TABLE B6

ALONG H-h**						
Muck Probe No.	**Latitude**	**Longitude**	**Northing (Y Co-Ordinate)**	**Easting (X Co-ordinate)**	**Surface Water Height (inches)**	**Muck Depth (inches)**
MP43	26.3858	80.572	746160	796273	6	12
MP44	26.3858	80.5679	746134	797628	18	15
MP45	26.3858	80.5625	746140	799392	18	17
MP46	26.3856	80.5571	746086	801147	12	17
MP47	26.3849	80.5739	745825	795664	12	15
MP48	26.3849	80.558	745832	800875	18	10
MP49	26.3848	80.5618	745808	799630	18	22
MP50	26.3847	80.5658	745763	798329	12	6
MP51	26.3847	80.5693	745739	797156	18	16
Average Values					14.6	14.4

**: RADISE field indicators; see Sheets 3A through 3E in the Appendix B

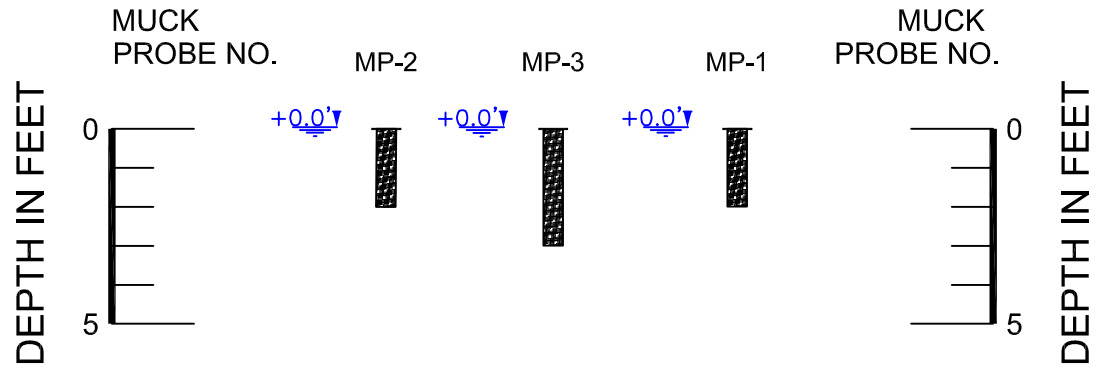
TABLE B7

ALONG I-i1**						
Muck Probe No.	**Latitude**	**Longitude**	**Northing (Y Co-Ordinate)**	**Easting (X Co-ordinate)**	**Surface Water Height (inches)**	**Muck Depth (inches)**
MP52	26.3784	80.5618	743486	799628	18	14
MP53	26.3784	80.5693	743447	797173	12	12
MP54	26.3784	80.556	743462	801520	12	9
MP55	26.3779	80.5695	743275	797119	18	11
MP56	26.3779	80.5561	743280	801502	12	9
MP57	26.3779	80.5403	743298	806659	18	4
MP58	26.3778	80.55	743267	803503	18	15
MP59	26.3778	80.5233	743288	812252	18	18
MP60	26.3776	80.5612	743194	799829	12	9
MP61	26.3775	80.531	743178	809715	18	4
Average Values					15.6	10.5

**: RADISE field indicators; see Sheets 3A through 3E in the Appendix B

ALONG C1-c

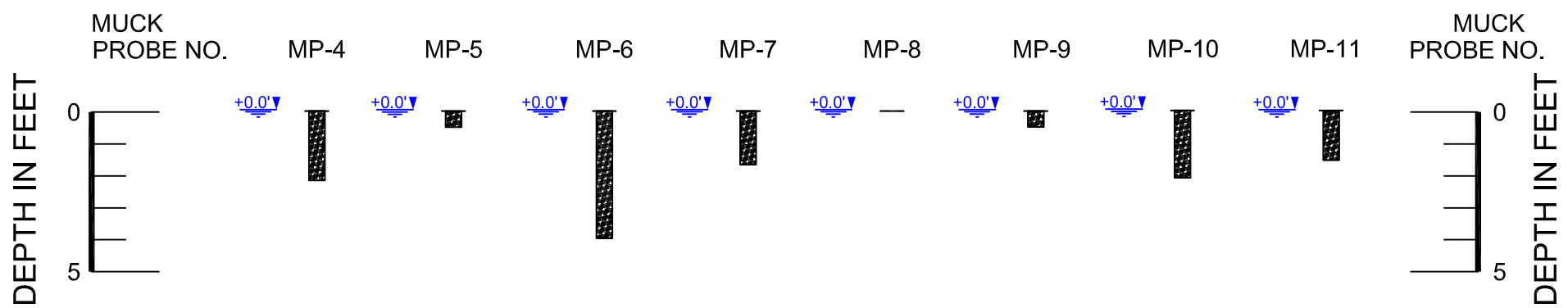
MUCK PROBE NO.	NORTHING	EASTING
MP-2	759244	801847
MP-3	759248	802811
MP-1	759266	805184

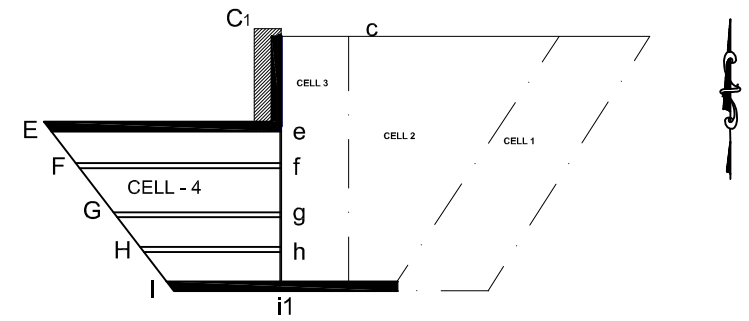


ALONG C1-e

MUCK PROBE NO.	NORTHING	EASTING
MP-4	758789	801504
MP-5	757224	801518
MP-6	755942	801522
MP-7	755265	801525

MUCK PROBE NO.	NORTHING	EASTING
MP-8	754902	801526
MP-9	754902	801526
MP-10	754316	801528
MP-11	753811	801412





- Hatch Area Indicates Muck Probe Area.
- Inflow Canal, Discharge Canal and Associated Levees
Ee, Ff - Existing Farm Berms/Mounds

KEY MAP
NOT TO SCALE

LEGEND

- Dark brown to black organic silt to fibrous peat (PT)
- MP-2 — Muck Probe Number
- +0.0' — Standing Water Height
- NR — Not Recorded
- 0.5' — Groundwater Depth
- N759244 E801847 — Northings and Eastings are referenced to the NAD 1983

NOTES

(1) Muck depths were determined by using a hand held 3/8" diameter steel rod. Muck probing was performed on October 2004.

(2) Water Levels shown on the subsurface profiles represent water level on the probed dates with an accuracy of 0.5 feet. Water level fluctuations should be anticipated throughout the year and are expressed in feet.

(3) Muck probe data shown are for subsoil characterization purpose only. Contrators shall provide independent verification of data for quantity take-off/bidding purposes. RADISE International is not responsible for interpretation of probe data by others.

(4) Muck Probes shown are sorted by Easting in ascending order.

REVISIONS							Names	Dates
Date.	By	Descriptions	Date.	By	Descriptions	Drawn by	EA	04/25/05
						Checked by	V V	04/25/05
						Designed by		
						Checked by		
						Approved by	K A A	

RADISE Infrastructure Engineers & Software Developers
LICENSE NO. - 8901

ENGINEER OF RECORD
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TEL 561-841-0103 FAX 561-841-0104
URL : http:// www.radise.net

SOUTH FLORIDA WATER MANAGEMENT DISTRICT	
COUNTY	CONTRACT NO
PALM BEACH	CN040935

SCALE: VERTICAL 1" = 5'
SCALE: HORIZONTAL N/A

SHEET TITLE: MUCK PROFILES

PROJECT NAME: STA 2/CELL 4 EXPANSION PROJECT
PALM BEACH COUNTY
FLORIDA

SHEET NO. 3A

RADISE PROJECT NO: 04/RB/GEOT/0701

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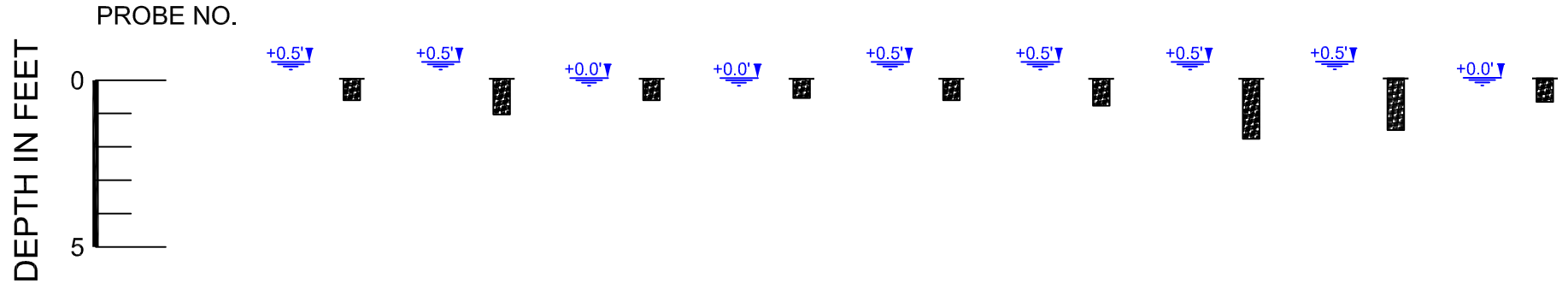
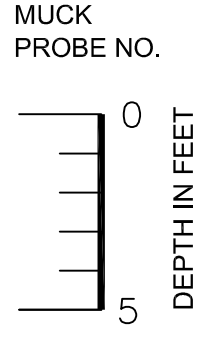
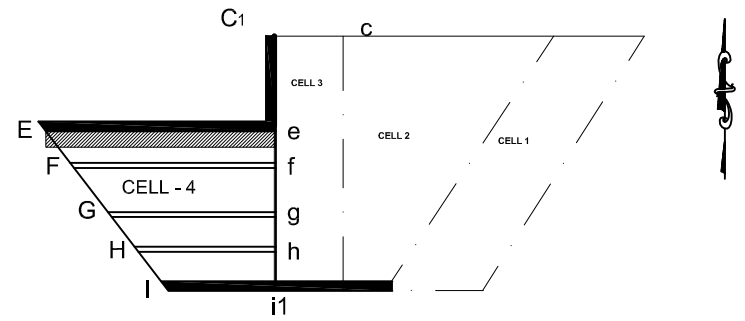
ALONG E-e

MUCK PROBE NO.	NORTHING	EASTING
MP-15	753484	791057
MP-13	753517	792120
MP-12	753602	793402
MP-14	753526	794784
MP-16	753379	796112

MUCK PROBE NO.	NORTHING	EASTING
MP-17	753252	797513
MP-20	752989	800269
MP-18	753122	800768
MP-19	753013	801514







▨ - Hatch Area Indicates Muck Probe Area.

■ - Inflow Canal, Discharge Canal and Associated Levees

Ee, Ff - Existing Farm Berms/Mounds

KEY MAP

NOT TO SCALE

LEGEND

	Dark brown to black organic silt to fibrous peat (PT)
MP-15	Muck Probe Number
+0.5'	Standing Water Height
NR	Not Recorded
0.5'	Groundwater Depth
N753484 E791057	Northings and Eastings are referenced to the NAD 1983

NOTES

(1) Muck depths were determined by using a hand held 3/8" diameter steel rod. Muck probing was performed on October 2004.

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REVISIONS							Names	Dates
Date.	By	Descriptions	Date.	By	Descriptions	Drawn by	EA	04/25/05
						Checked by	V V	04/25/05
						Designed by		
						Checked by		
						Approved by	K A A	

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URL : http:// www.radise.net

SOUTH FLORIDA WATER MANAGEMENT DISTRICT	
COUNTY	CONTRACT NO
PALM BEACH	CN040935

SCALE: VERTICAL 1" = 5'

SCALE: HORIZONTAL N/A

SHEET TITLE: MUCK PROFILES

PROJECT NAME: STA 2/CELL 4 EXPANSION PROJECT PALM BEACH COUNTY FLORIDA

SHEET NO. 3 B

RADISE PROJECT NO: 04/RB/GEOT/0701

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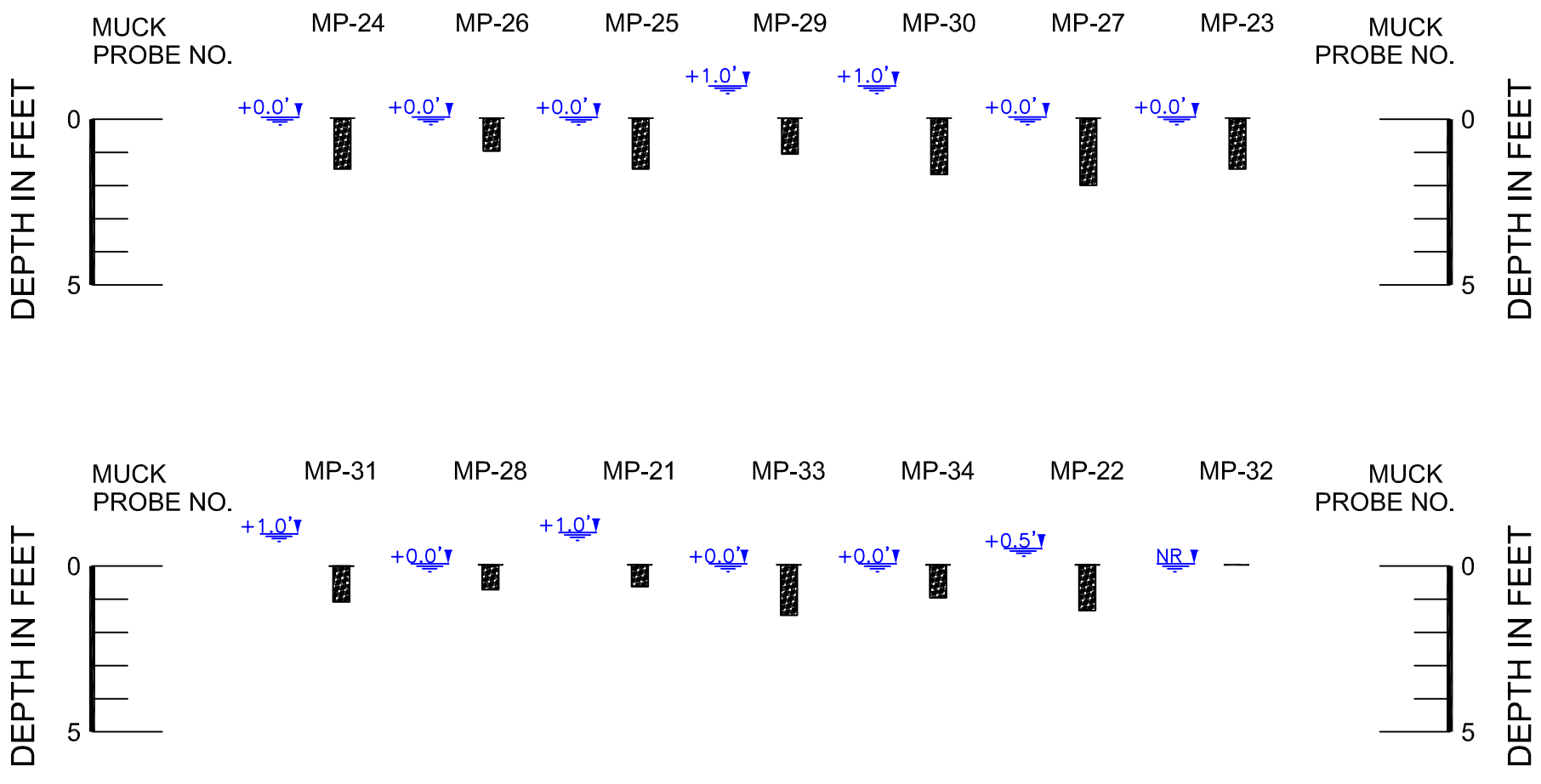
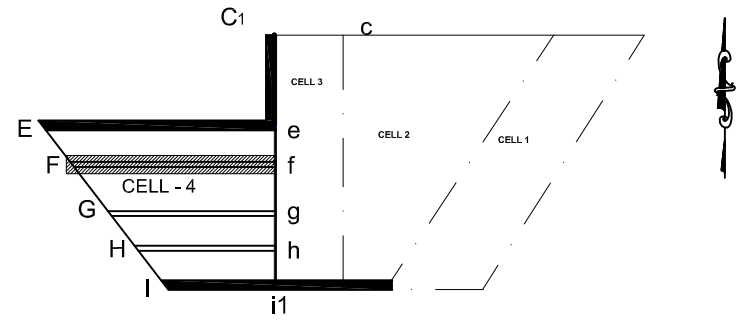
ALONG F-f

MUCK PROBE NO.	NORTHING	EASTING
MP-24	751315	791773
MP-26	751298	792764
MP-25	751308	792773
MP-29	751100	793838
MP-30	751105	795365
MP-27	751258	796028
MP-23	751369	796046

MUCK PROBE NO.	NORTHING	EASTING
MP-31	751062	797802
MP-28	751147	799120
MP-21	751441	799301
MP-33	750999	799966
MP-34	750365	800614
MP-22	751446	800829
MP-32	751014	801521





▨ - Hatch Area Indicates Muck Probe Area.

■ - Inflow Canal, Discharge Canal and Associated Levees

Ee, Ff - Existing Farm Berms/Mounds

KEY MAP

NOT TO SCALE

LEGEND

- Dark brown to black organic silt to fibrous peat (PT)
- MP-24 — Muck Probe Number
- +0.0' — Standing Water Height
- NR — Not Recorded
- 0.5' — Groundwater Depth
- N751315 E791773 — Northings and Eastings are referenced to the NAD 1983

NOTES

(1) Muck depths were determined by using a hand held 3/8" diameter steel rod. Muck probing was performed on October 2004.

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REVISIONS							Names	Dates
Date.	By	Descriptions	Date.	By	Descriptions	Drawn by	EA	04/25/05
						Checked by	V V	04/25/05
						Designed by		
						Checked by		
						Approved by	K A A	

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URL : http:// www.radise.net

SOUTH FLORIDA WATER MANAGEMENT DISTRICT		SCALE: VERTICAL 1" = 5'	SHEET TITLE: MUCK PROFILES	SHEET NO. 3 C
COUNTY	CONTRACT NO	SCALE: HORIZONTAL N/A	PROJECT NAME: STA 2/CELL 4 EXPANSION PROJECT PALM BEACH COUNTY FLORIDA	RADISE PROJECT NO: 04/RB/GEOT/0701
PALM BEACH	CN040935			

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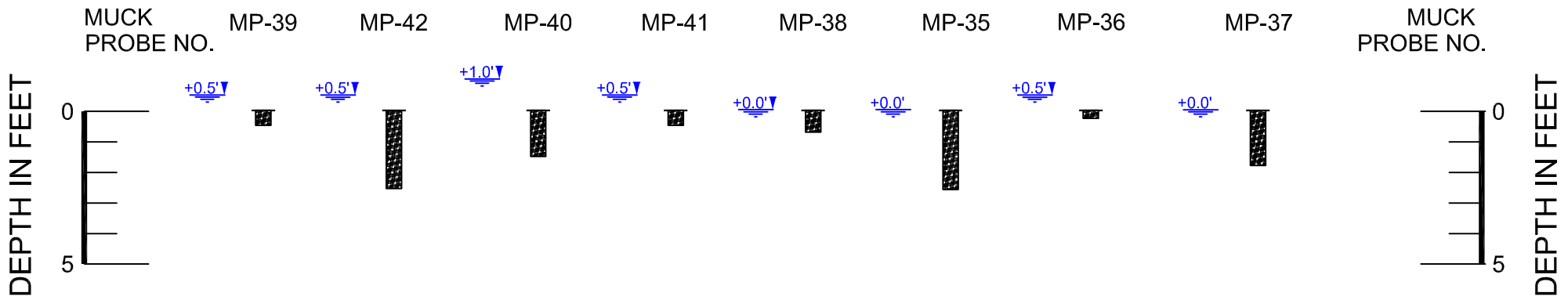
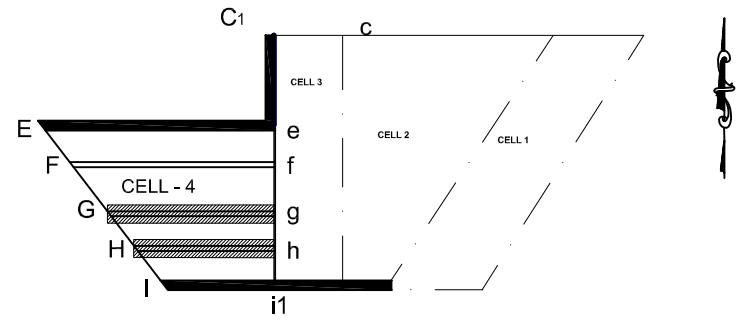
ALONG G-g

MUCK PROBE NO.	NORTHING	EASTING
MP-39	748810	794463
MP-42	748703	795755
MP-40	748782	798346
MP-41	748744	799138

MUCK PROBE NO.	NORTHING	EASTING
MP-38	748849	800247
MP-35	749375	800354
MP-36	749367	801027
MP-37	749298	801518





▨ - Hatch Area Indicates Muck Probe Area.

■ - Inflow Canal, Discharge Canal and Associated Levees

Ee, Ff - Existing Farm Berms/Mounds

KEY MAP
NOT TO SCALE

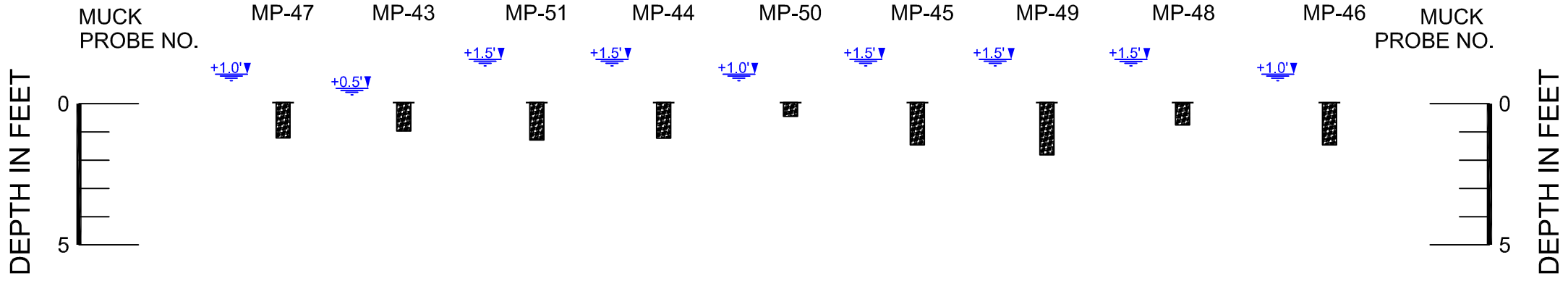
LEGEND

	Dark brown to black organic silt to fibrous peat (PT)
MP-39	Muck Probe Number
+0.5'	Standing Water Height
NR	Not Recorded
0.5'	Groundwater Depth
N748810 E794463	Northings and Eastings are referenced to the NAD 1983

ALONG H-h

MUCK PROBE NO.	NORTHING	EASTING
MP-47	745825	795664
MP-43	746160	796273
MP-51	745739	797156
MP-44	746134	797628
MP-50	745763	798329

MUCK PROBE NO.	NORTHING	EASTING
MP-45	746140	799392
MP-49	745808	799630
MP-48	745832	800875
MP-46	746086	801147



NOTES

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						Checked by		
						Approved by	K A A	

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SOUTH FLORIDA WATER MANAGEMENT DISTRICT	
COUNTY	CONTRACT NO
PALM BEACH	CN040935

SCALE: VERTICAL 1" = 5'

SCALE: HORIZONTAL N/A

SHEET TITLE: MUCK PROFILES

PROJECT NAME: STA 2/CELL 4 EXPANSION PROJECT PALM BEACH COUNTY FLORIDA

SHEET NO. 3 D

RADISE PROJECT NO: 04/RB/GEOT/0701

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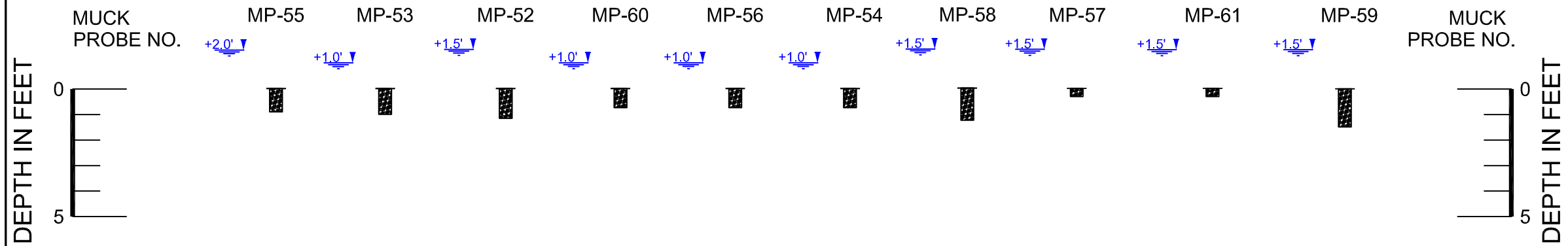
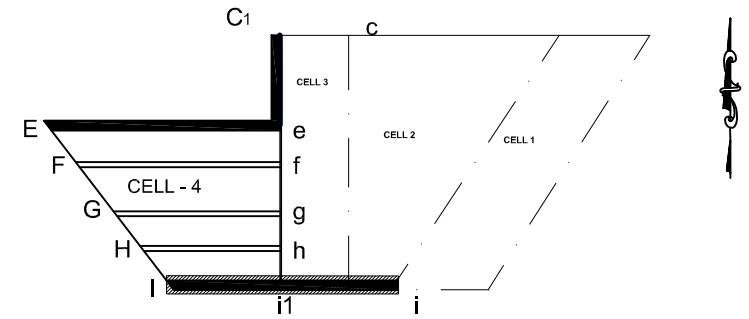
ALONG I-i

MUCK PROBE NO.	NORTHING	EASTING
MP-55	743275	797119
MP-53	743447	797173
MP-52	743486	799628
MP-60	743194	799829
MP-56	743280	801502

MUCK PROBE NO.	NORTHING	EASTING
MP-54	743462	801520
MP-58	743267	803503
MP-57	743298	806659
MP-61	743178	809715
MP-59	743288	812252





▨ - Hatch Area Indicates Muck Probe Area.

■ - Inflow Canal, Discharge Canal and Associated Levees

Ee, Ff - Existing Farm Berms/Mounds

KEY MAP

NOT TO SCALE

LEGEND

▩	Dark brown to black organic silt to fibrous peat (PT)
MP-55	Muck Probe Number
+2.0'	Standing Water Height
NR	Not Recorded
0.5'	Groundwater Depth
N743275 E797119	Northings and Eastings are referenced to the NAD 1983

NOTES

(1) Muck depths were determined by using a hand held 3/8" diameter steel rod. Muck probing was performed on October 2004.

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(4) Muck Probes shown are sorted by Easting in ascending order.

REVISIONS							Names	Dates
Date.	By	Descriptions	Date.	By	Descriptions	Drawn by	EA	04/25/05
						Checked by	V V	04/25/05
						Designed by		
						Checked by		
						Approved by	K A A	

RADISE Infrastructure Engineers & Software Developers

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URL : http:// www.radise.net

SOUTH FLORIDA WATER MANAGEMENT DISTRICT	
COUNTY	CONTRACT NO
PALM BEACH	CN040935

SCALE: VERTICAL 1" = 5'

SCALE: HORIZONTAL N/A

SHEET TITLE: MUCK PROFILES

PROJECT NAME: STA 2/CELL 4 EXPANSION PROJECT
PALM BEACH COUNTY
FLORIDA

SHEET NO. 3 E

RADISE PROJECT NO: 04/RB/GEOT/0701

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APPENDIX C

TABLE C1
FIELD EXPLORATION INFORMATION
STA 2 EXPANSION PROJECT
PALM BEACH COUNTY, FLORIDA
CONTRACT CN-040935

BORING NO.	CORRESPONDING BORING NO. IN ALL TABLES	BORING TYPE*	NORTHING ** (feet)	EASTING ** (feet)	ELEVATION *** (feet)
CP04-STA2N-CB-00001	CB-00001	SPT	758,565.0	801,498.6	7.3
CP04-STA2N-CB-00002	CB-00002	CB	757,254.1	801,506.2	7.5
CP04-STA2N-CB-00003	CB-00003	SPT	755,600.8	801,520.9	7.3
CP04-STA2N-CB-00004	CB-00004	CB	754,265.8	801,535.3	7.2
CP04-STA2N-CB-00005	CB-00005	SPT	753,686.4	790,659.1	8.1
CP04-STA2N-CB-00006	CB-00006	SPT	753,602.3	791,675.7	7.4
CP04-STA2N-CB-00007	CB-00007	SPT	753,804.1	793,342.5	7.4
CP04-STA2N-CB-00008	CB-00008	CB	753,570.8	793,399.1	7.6
CP04-STA2N-CB-00009	CB-00009	CB	753,590.3	794,832.9	7.7
CP04-STA2N-CB-00010	CB-00010	SPT	753,733.1	796,972.5	8.2
CP04-STA2N-CB-00011	CB-00011	SPT	753,801.5	799,271.8	8.2
CP04-STA2N-CB-00012	CB-00012	CB	753,526.6	799,275.4	7.6
CP04-STA2N-CB-00013	CB-00013	CB	743,303.1	797,142.4	9.0
CP04-STA2N-CB-00014	CB-00014	SPT	743,320.0	798,935.2	8.3
CP04-STA2N-CB-00015	CB-00015	CB	743,319.2	803,137.0	8.5
CP04-STA2N-CB-00016	CB-00016	SPT	743,329.1	800,917.9	8.1
CP04-STA2N-CB-00017	CB-00017	CB	743,318.6	799,761.4	8.3
CP04-STA2N-CB-00018	CB-00018	SPT	743,267.3	806,847.8	8.3
CP04-STA2N-CB-00019	CB-00019	CB	743,311.0	798,052.1	8.5
CP04-STA2N-CB-00020	CB-00020	SPT	743,280.7	808,981.4	8.1
CP04-STA2N-CB-00021	CB-00021	CB	743,333.7	804,766.5	7.5
CP04-STA2N-CB-00022	CB-00022	SPT	746,417.2	796,279.4	8.5
CP04-STA2N-CB-00023	CB-00023	SPT	746,024.0	796,578.5	6.4
CP04-STA2N-CB-00024	CB-00024	SPT	753,777.9	801,358.0	7.6

NOTES

BORING TYPE*

SPT: Standard Penetration Test Boring

CB: Rock Core Boring

NORTHING/EASTING** North America Datum of 1983/99

ELEVATION*** North American Vertical Datum of 1988

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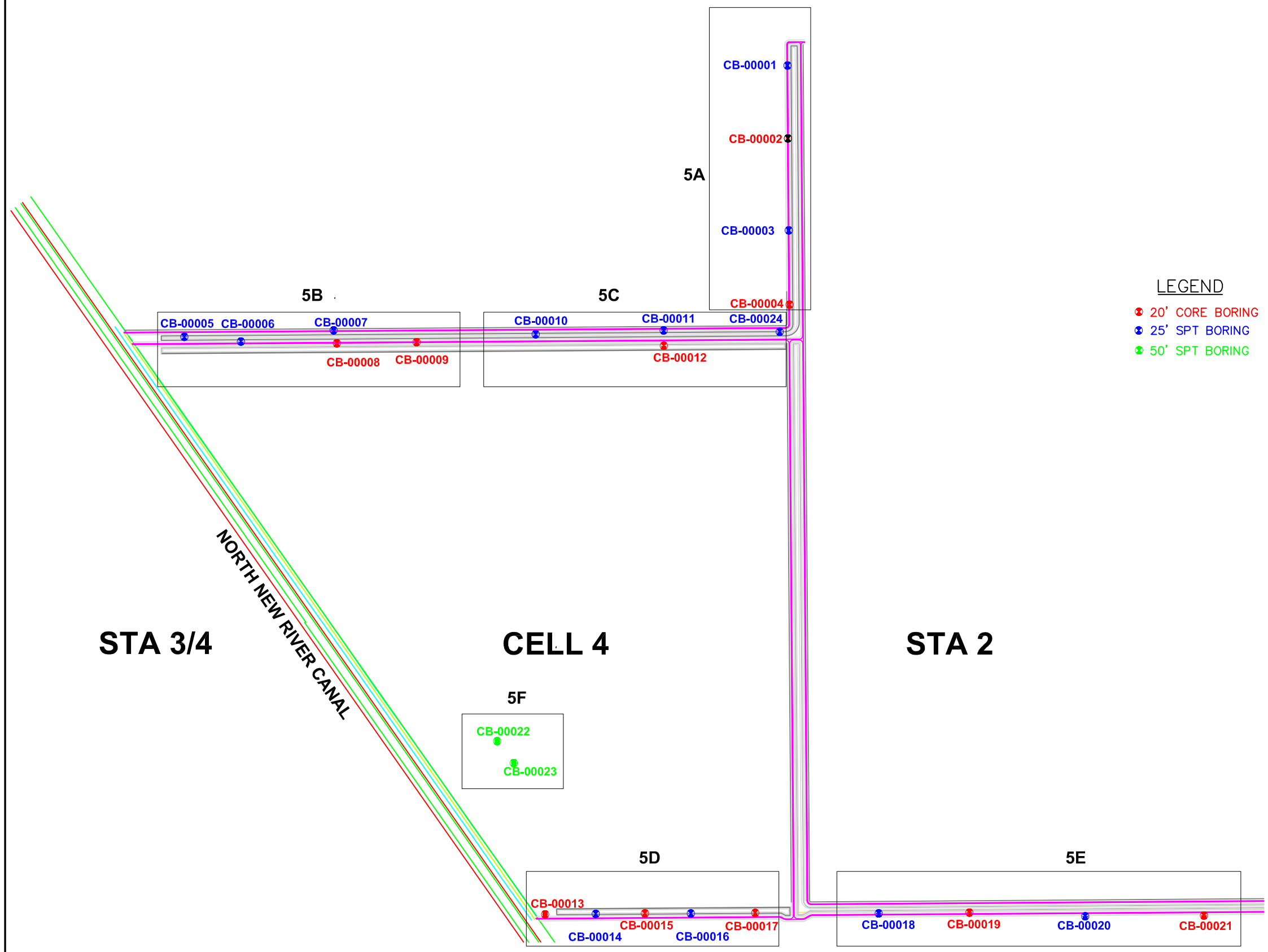

LEGEND

- 20' CORE BORING
- 25' SPT BORING
- 50' SPT BORING

REVISIONS							Names	Dates
Date.	By	Descriptions	Date.	By	Descriptions	Drawn by	EA	04/25/05
						Checked by	V V	04/25/05
						Designed by		
						Checked by		
						Approved by	K A A	

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SOUTH FLORIDA WATER MANAGEMENT DISTRICT

COUNTY	CONTRACT NO
PALM BEACH	CN040935

SCALE: VERTICAL N/A

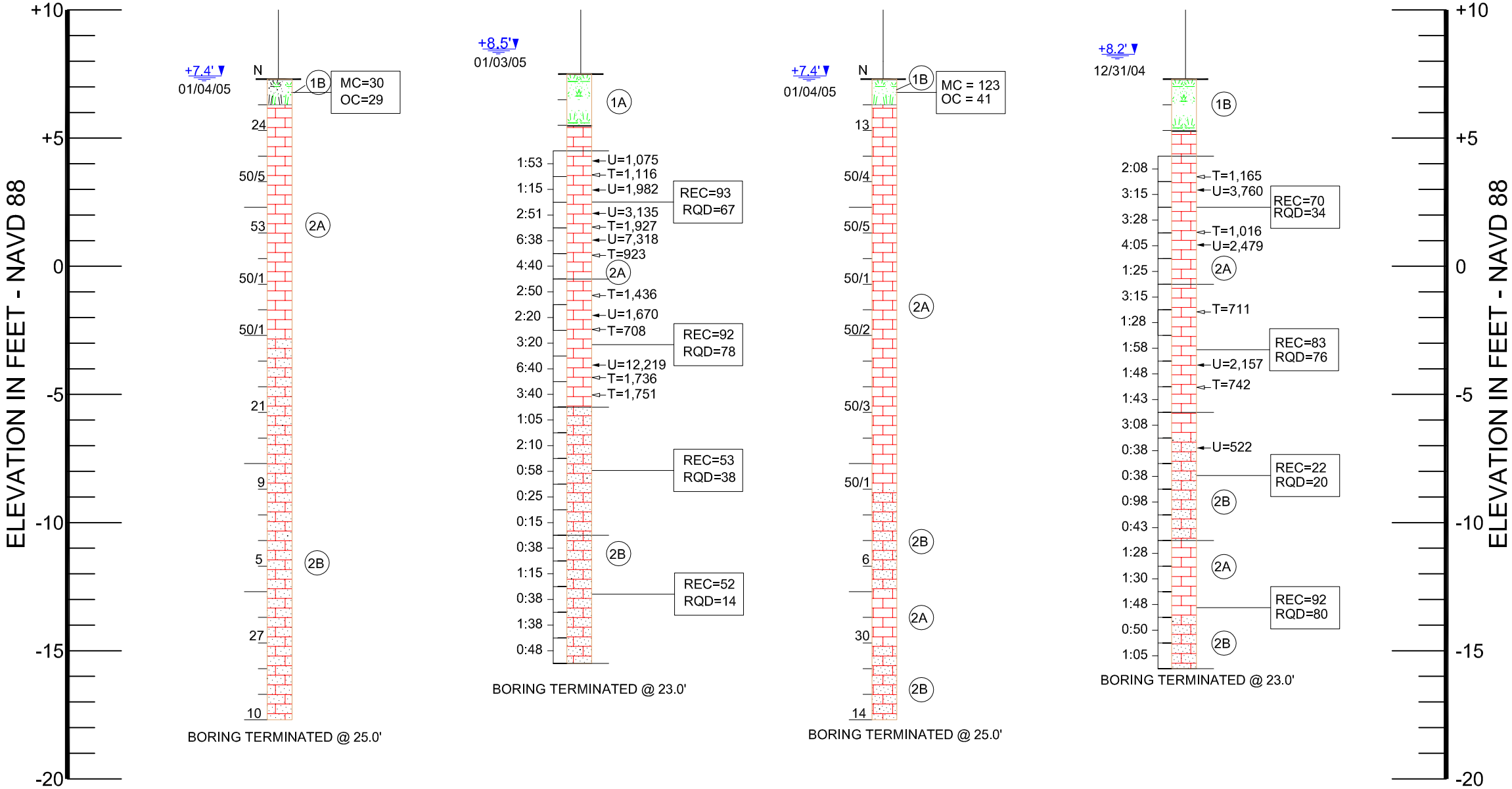
SCALE: HORIZONTAL 1"=2000'

SHEET TITLE: BORING LOCATION PLAN

PROJECT NAME: STA 2/CELL 4 EXPANSION PROJECT
PALM BEACH COUNTY
FLORIDA

SHEET NO. 4

RADISE PROJECT NO: 04/RB/GEOT/0701



LEGEND

1A	DARK BROWN FIBROUS PEAT WITH TRACES TRACES OF ORGANIC SILT AND CLAY (PT)
1B	DARK BROWN ORGANIC SILT AND CLAY WITH SOME FIBROUS PEAT (PT)
2A	GRAY, BROWN AND TAN LIMESTONE
2B	GRAY TO TAN SILTY TO SLIGHTLY SILTY CALCAREOUS SAND (SM) AND LIMESTONE SEAMS AND SHELL
3	GRAY, GREEN SLIGHTLY SILTY TO SILTY FINE SAND WITH LIMESTONE SEAMS AND SHELL (SP-SM)(SM)
N	STANDARD PENETRATION RESISTANCE (BLOWS PER FOOT)
50/5	INDICATES THAT 50 BLOWS ARE REQUIRED TO DRIVE SAMPLER 5 INCHES

STANDARD PENETRATION TEST DATA

SPOON INSIDE DIA.	1.375 INCH
SPOON OUTSIDE DIA.	2.0 INCHES
AVG. HAMMER DROP	30 INCHES
HAMMER WEIGHT	140 POUNDS

+7.4' ▼ 01/04/05	GROUNDWATER ELEVATION FEET- NAVD 88 ON THE DRILLING DATE
1:53	DRILLING TIME (MIN:SEC) REQUIRED FOR A DEPTH SHOWN WITH DOWNWARD PRESSURE 400-500 PSI
N758565.0 E801498.6	NORTHING AND EASTING ARE REFERENCED TO NORTH AMERICAN VERTICAL DATUM OF 1988 AND EXPRESSED IN FEET, OBTAINED FROM PROJECT SURVEYOR
NR	NOT RECORDED
REC	CORE RECOVERY (%)
RQD	ROCK QUALITY DESIGNATION (%)
◄ U=1,075	UNCONFINED COMPRESSIVE STRENGTH (PSI)
◄ T=1,116	SPLITTING TENSILE STRENGTH (PSI)
PT	UNIFIED SOIL CLASSIFICATION SYSTEM GROUP SYMBOL (ASTM D 2487)
MC	NATURAL MOISTURE CONTENT (%)
OC	ORGANIC CONTENT (%)
-200	AMOUNT PASSING U.S. No. 200 SIEVE (%)

NOTES

(1) BORINGS WERE DRILLED ON DECEMBER 2004 & JANUARY 2005 USING A CENTRAL MINE EQUIPMENT (CME 55) ON MUD-BUG / TRACK MOUNTED VEHICLES.

(2) STRATA BOUNDARIES ARE APPROXIMATE AND REPRESENT SOIL STRATA AT EACH TEST HOLE LOCATION ONLY. SOIL TRANSITIONS MAY BE MORE GRADUAL THAN IMPLIED.

(3) GROUNDWATER ELEVATIONS SHOWN ON THE SUBSURFACE PROFILES REPRESENT GROUNDWATER SURFACES ON THE DATES SHOWN. GROUNDWATER LEVEL FLUCTUATIONS SHOULD BE ANTICIPATED THROUGHOUT THE YEAR.

REVISIONS

Date.	By	Descriptions	Date.	By	Descriptions

	Names	Dates
Drawn by	EA	04/25/05
Checked by	V V	04/25/05
Designed by		
Checked by		
Approved by	K A A	

RADISE Infrastructure Engineers & Software Developers

LICENSE NO. - 8901

ENGINEER OF RECORD
KUMAR. A. ALLADY (P.E.No. - 52845)
RADISE International
4152 West Blue Heron Boulevard, Suite 116
Riviera Beach, Florida, 33404
TEL 561-841-0103 FAX 561-841-0104
URL : http:// www.radise.net

SOUTH FLORIDA WATER MANAGEMENT DISTRICT

COUNTY	CONTRACT NO
PALM BEACH	CN040935

SCALE: VERTICAL 1" = 5'

SCALE: HORIZONTAL N/A

SHEET TITLE: SUBSURFACE PROFILES

PROJECT NAME: STA 2/CELL 4 EXPANSION PROJECT
PALM BEACH COUNTY
FLORIDA

SHEET NO. 5 A

RADISE PROJECT NO: 04/RB/GEOT/0701

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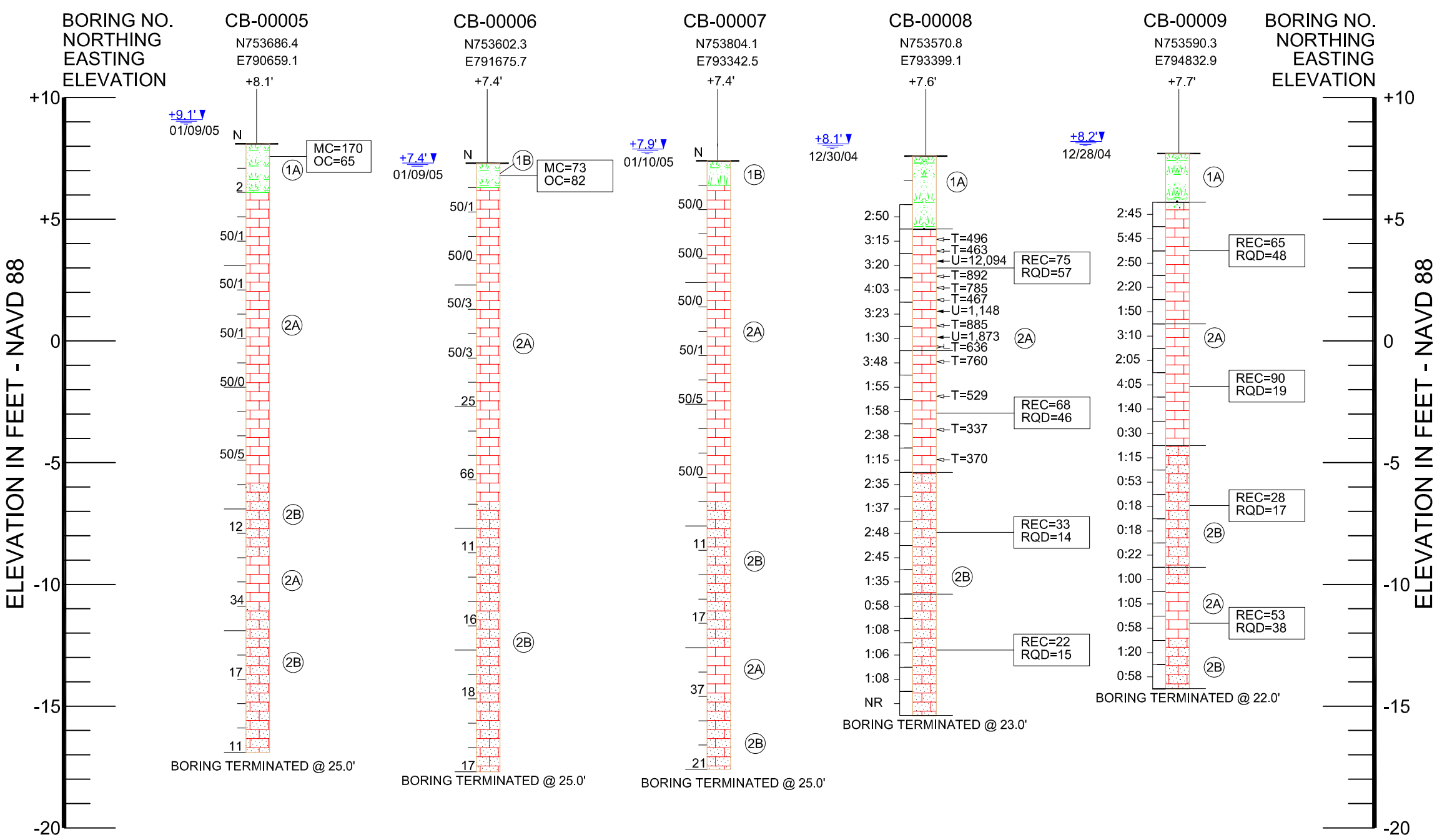

LEGEND

1A	DARK BROWN FIBROUS PEAT WITH TRACES TRACES OF ORGANIC SILT AND CLAY (PT)
1B	DARK BROWN ORGANIC SILT AND CLAY WITH SOME FIBROUS PEAT (PT)
2A	GRAY, BROWN AND TAN LIMESTONE
2B	GRAY TO TAN SILTY TO SLIGHTLY SILTY CALCAREOUS SAND (SM) AND LIMESTONE SEAMS AND SHELL
3	GRAY, GREEN SLIGHTLY SILTY TO SILTY FINE SAND WITH LIMESTONE SEAMS AND SHELL (SP-SM)(SM)
N	STANDARD PENETRATION RESISTANCE (BLOWS PER FOOT)
50/1	INDICATES THAT 50 BLOWS ARE REQUIRED TO DRIVE SAMPLER 1 INCH

STANDARD PENETRATION TEST DATA

SPOON INSIDE DIA.	1.375 INCH
SPOON OUTSIDE DIA.	2.0 INCHES
AVG. HAMMER DROP	30 INCHES
HAMMER WEIGHT	140 POUNDS

+9.1' ▼ 01/09/05	GROUNDWATER ELEVATION FEET- NAVD 88 ON THE DRILLING DATE
2:50	DRILLING TIME (MIN:SEC) REQUIRED FOR A DEPTH SHOWN WITH DOWNWARD PRESSURE 400-500 PSI
N753686.4 E790659.1	NORTHING AND EASTING ARE REFERENCED TO NORTH AMERICAN VERTICAL DATUM OF 1988 AND EXPRESSED IN FEET, OBTAINED FROM PROJECT SURVEYOR
NR	NOT RECORDED
REC	CORE RECOVERY (%)
RQD	ROCK QUALITY DESIGNATION (%)
◄– U=12,094	UNCONFINED COMPRESSIVE STRENGTH (PSI)
◄– T=496	SPLITTING TENSILE STRENGTH (PSI)
PT	UNIFIED SOIL CLASSIFICATION SYSTEM GROUP SYMBOL (ASTM D 2487)
MC	NATURAL MOISTURE CONTENT (%)
OC	ORGANIC CONTENT (%)
-200	AMOUNT PASSING U.S. No. 200 SIEVE (%)

NOTES

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SOUTH FLORIDA WATER MANAGEMENT DISTRICT

COUNTY	CONTRACT NO
PALM BEACH	CN040935

SCALE: VERTICAL 1" = 5'
SCALE: HORIZONTAL N/A

SHEET TITLE: SUBSURFACE PROFILES

PROJECT NAME: STA 2/CELL 4 EXPANSION PROJECT
PALM BEACH COUNTY
FLORIDA

SHEET NO. 5 B

RADISE PROJECT NO: 04/RB/GEOT/0701

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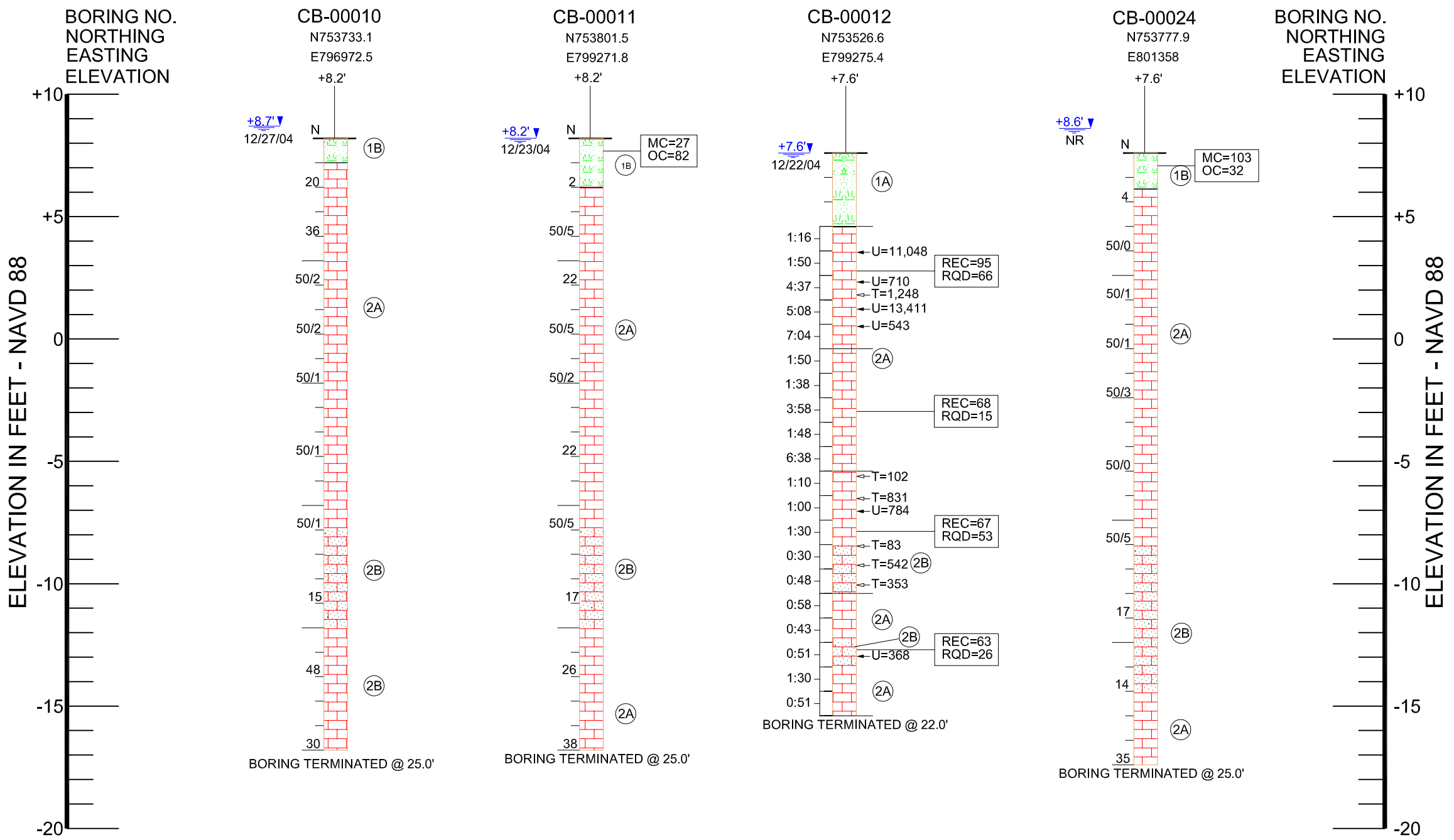

LEGEND

1A	DARK BROWN FIBROUS PEAT WITH TRACES TRACES OF ORGANIC SILT AND CLAY (PT)
1B	DARK BROWN ORGANIC SILT AND CLAY WITH SOME FIBROUS PEAT (PT)
2A	GRAY, BROWN AND TAN LIMESTONE
2B	GRAY TO TAN SILTY TO SLIGHTLY SILTY CALCAREOUS SAND (SM) AND LIMESTONE SEAMS AND SHELL
3	GRAY, GREEN SLIGHTLY SILTY TO SILTY FINE SAND WITH LIMESTONE SEAMS AND SHELL (SP-SM)(SM)
N	STANDARD PENETRATION RESISTANCE (BLOWS PER FOOT)
50/2	INDICATES THAT 50 BLOWS ARE REQUIRED TO DRIVE SAMPLER 2 INCHES

STANDARD PENETRATION TEST DATA

SPOON INSIDE DIA.	1.375 INCH
SPOON OUTSIDE DIA.	2.0 INCHES
AVG. HAMMER DROP	30 INCHES
HAMMER WEIGHT	140 POUNDS

+8.7' ▼ 12/27/04	GROUNDWATER ELEVATION FEET- NAVD 88 ON THE DRILLING DATE
1:16	DRILLING TIME (MIN:SEC) REQUIRED FOR A DEPTH SHOWN WITH DOWNWARD PRESSURE 400-500 PSI
N753733.1 E796972.5	NORTHING AND EASTING ARE REFERENCED TO NORTH AMERICAN VERTICAL DATUM OF 1988 AND EXPRESSED IN FEET, OBTAINED FROM PROJECT SURVEYOR
NR	NOT RECORDED
REC	CORE RECOVERY (%)
RQD	ROCK QUALITY DESIGNATION (%)
← U=11,048	UNCONFINED COMPRESSIVE STRENGTH (PSI)
← T=1,248	SPLITTING TENSILE STRENGTH (PSI)
PT	UNIFIED SOIL CLASSIFICATION SYSTEM GROUP SYMBOL (ASTM D 2487)
MC	NATURAL MOISTURE CONTENT (%)
OC	ORGANIC CONTENT (%)
-200	AMOUNT PASSING U.S. No. 200 SIEVE (%)

NOTES

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SOUTH FLORIDA WATER MANAGEMENT DISTRICT

COUNTY	CONTRACT NO
PALM BEACH	CN040935

SCALE: VERTICAL 1" = 5'
SCALE: HORIZONTAL N/A

SHEET TITLE: SUBSURFACE PROFILES

PROJECT NAME: STA 2/CELL 4 EXPANSION PROJECT
PALM BEACH COUNTY
FLORIDA

SHEET NO. 5 C

RADISE PROJECT NO: 04/RB/GEOT/0701

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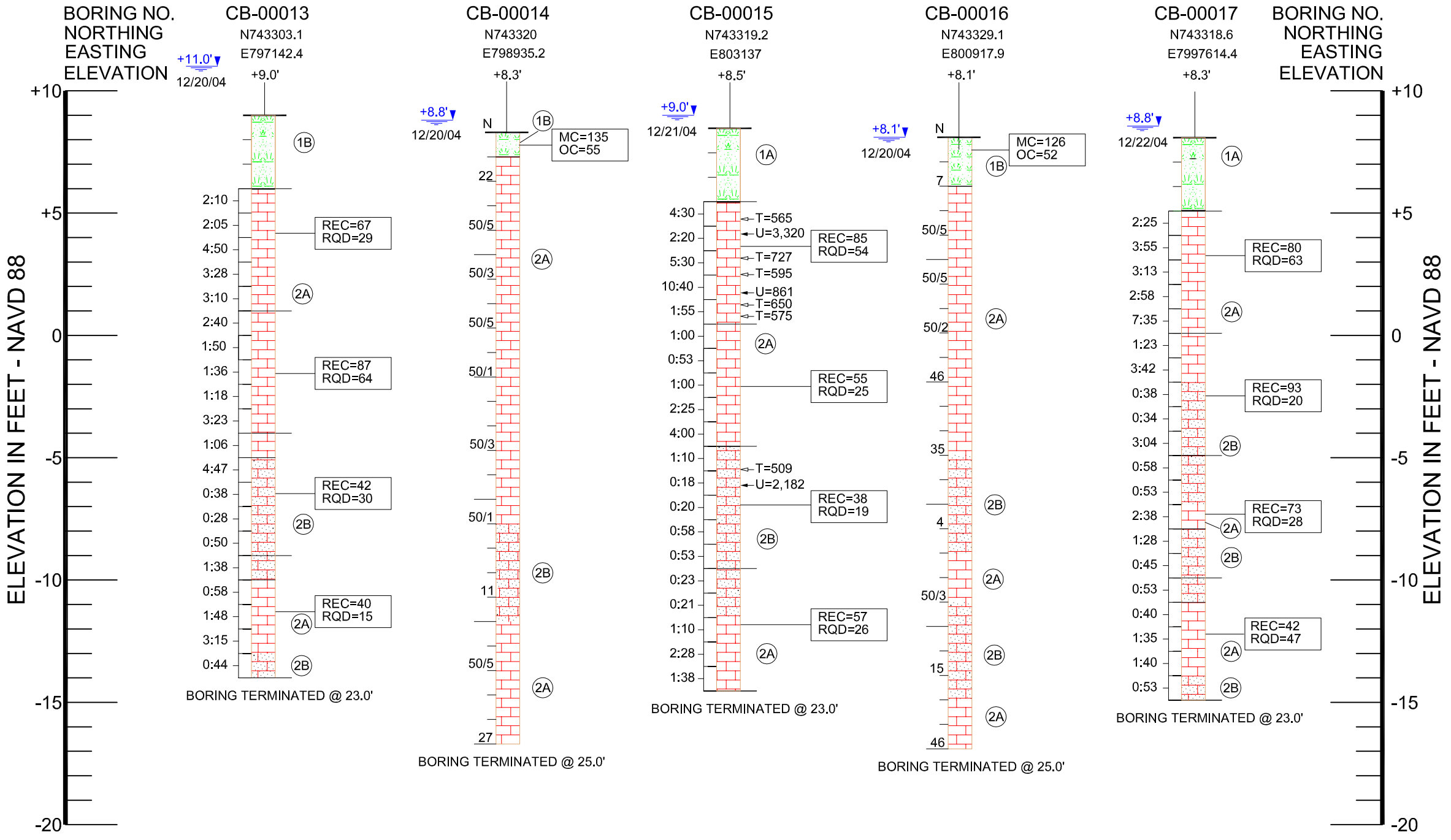

LEGEND

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2A	GRAY, BROWN AND TAN LIMESTONE
2B	GRAY TO TAN SILTY TO SLIGHTLY SILTY CALCAREOUS SAND (SM) AND LIMESTONE SEAMS AND SHELL
3	GRAY, GREEN SLIGHTLY SILTY TO SILTY FINE SAND WITH LIMESTONE SEAMS AND SHELL (SP-SM)(SM)
N	STANDARD PENETRATION RESISTANCE (BLOWS PER FOOT)
50/5	INDICATES THAT 50 BLOWS ARE REQUIRED TO DRIVE SAMPLER 5 INCHES

STANDARD PENETRATION TEST DATA

SPOON INSIDE DIA.	1.375 INCH
SPOON OUTSIDE DIA.	2.0 INCHES
AVG. HAMMER DROP	30 INCHES
HAMMER WEIGHT	140 POUNDS

+11.0' 12/20/04	GROUNDWATER ELEVATION FEET- NAVD 88 ON THE DRILLING DATE
2:10	DRILLING TIME (MIN:SEC) REQUIRED FOR A DEPTH SHOWN WITH DOWNWARD PRESSURE 400-500 PSI
N743303.1 E797142.4	NORTHING AND EASTING ARE REFERENCED TO NORTH AMERICAN VERTICAL DATUM OF 1988 AND EXPRESSED IN FEET, OBTAINED FROM PROJECT SURVEYOR
NR	NOT RECORDED
REC	CORE RECOVERY (%)
RQD	ROCK QUALITY DESIGNATION (%)
← T=565	UNCONFINED COMPRESSIVE STRENGTH (PSI)
◄U=3,320	SPLITTING TENSILE STRENGTH (PSI)
PT	UNIFIED SOIL CLASSIFICATION SYSTEM GROUP SYMBOL (ASTM D 2487)
MC	NATURAL MOISTURE CONTENT (%)
OC	ORGANIC CONTENT (%)
-200	AMOUNT PASSING U.S. No. 200 SIEVE (%)

NOTES

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SOUTH FLORIDA WATER MANAGEMENT DISTRICT	
COUNTY	CONTRACT NO
PALM BEACH	CN040935

SCALE: VERTICAL 1" = 5'
SCALE: HORIZONTAL N/A

SHEET TITLE: SUBSURFACE PROFILES
PROJECT NAME: STA 2/CELL 4 EXPANSION PROJECT PALM BEACH COUNTY FLORIDA

SHEET NO. 5 D
RADISE PROJECT NO: 04/RB/GEOT/0701

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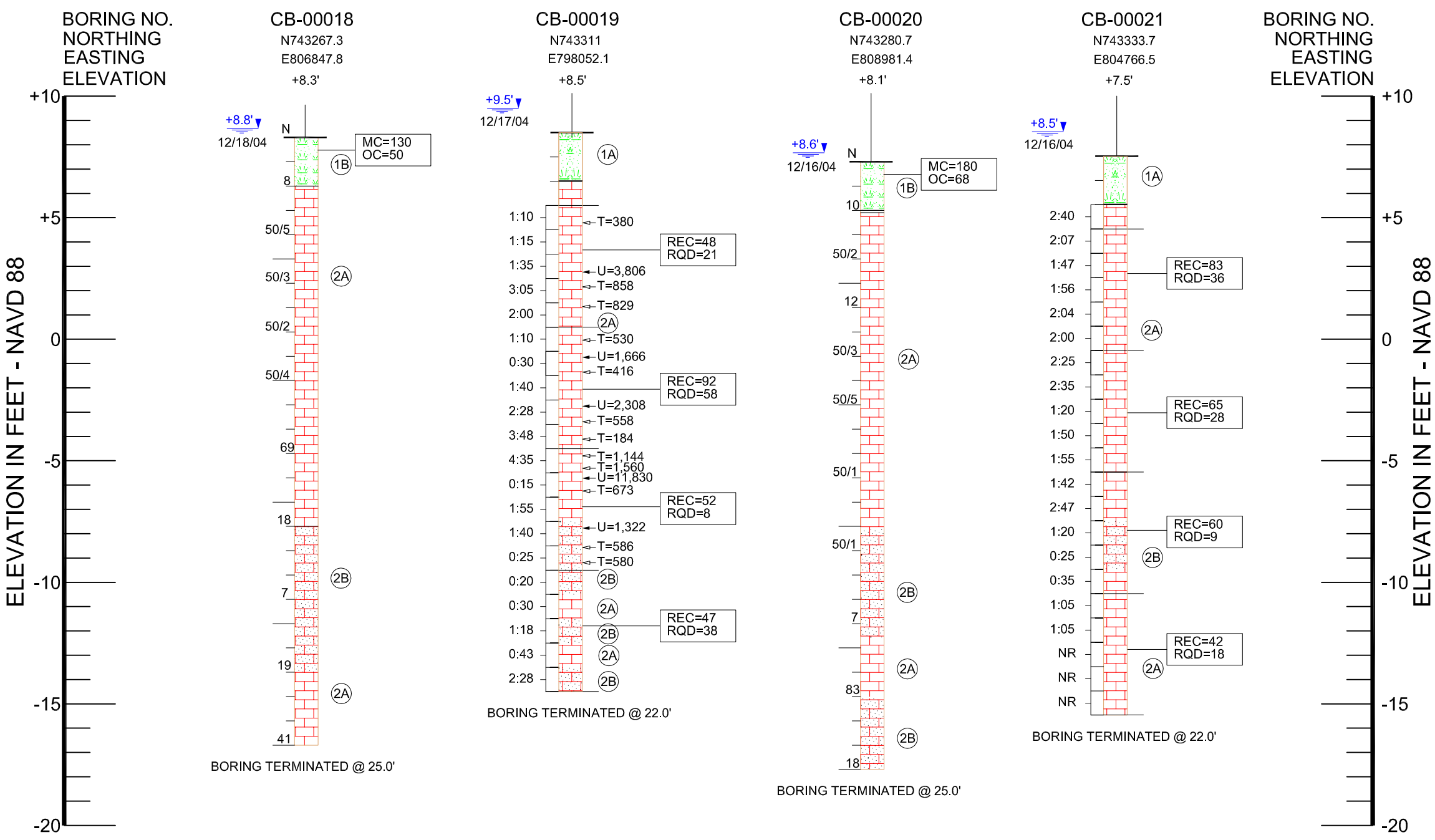

LEGEND

1A	DARK BROWN FIBROUS PEAT WITH TRACES TRACES OF ORGANIC SILT AND CLAY (PT)
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3	GRAY, GREEN SLIGHTLY SILTY TO SILTY FINE SAND WITH LIMESTONE SEAMS AND SHELL (SP-SM)(SM)
N	STANDARD PENETRATION RESISTANCE (BLOWS PER FOOT)
50/5	INDICATES THAT 50 BLOWS ARE REQUIRED TO DRIVE SAMPLER 5 INCHES

STANDARD PENETRATION TEST DATA

SPOON INSIDE DIA.	1.375 INCH
SPOON OUTSIDE DIA.	2.0 INCHES
AVG. HAMMER DROP	30 INCHES
HAMMER WEIGHT	140 POUNDS

+8.8' ▼ 12/18/04	GROUNDWATER ELEVATION FEET- NAVD 88 ON THE DRILLING DATE
1:10	DRILLING TIME (MIN:SEC) REQUIRED FOR A DEPTH SHOWN WITH DOWNWARD PRESSURE 400-500 PSI
N743267.3 E806847.8	NORTHING AND EASTING ARE REFERENCED TO NORTH AMERICAN VERTICAL DATUM OF 1988 AND EXPRESSED IN FEET, OBTAINED FROM PROJECT SURVEYOR
NR	NOT RECORDED
REC	CORE RECOVERY (%)
RQD	ROCK QUALITY DESIGNATION (%)
← U=3,806	UNCONFINED COMPRESSIVE STRENGTH (PSI)
◄ T=380	SPLITTING TENSILE STRENGTH (PSI)
PT	UNIFIED SOIL CLASSIFICATION SYSTEM GROUP SYMBOL (ASTM D 2487)
MC	NATURAL MOISTURE CONTENT (%)
OC	ORGANIC CONTENT (%)
-200	AMOUNT PASSING U.S. No. 200 SIEVE (%)

NOTES

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SOUTH FLORIDA WATER MANAGEMENT DISTRICT

COUNTY	CONTRACT NO
PALM BEACH	CN040935

SCALE: VERTICAL 1" = 5'

SCALE: HORIZONTAL N/A

SHEET TITLE: SUBSURFACE PROFILES

PROJECT NAME: STA 2/CELL 4 EXPANSION PROJECT
PALM BEACH COUNTY
FLORIDA

SHEET NO. 5 E

RADISE PROJECT NO: 04/RB/GEOT/0701

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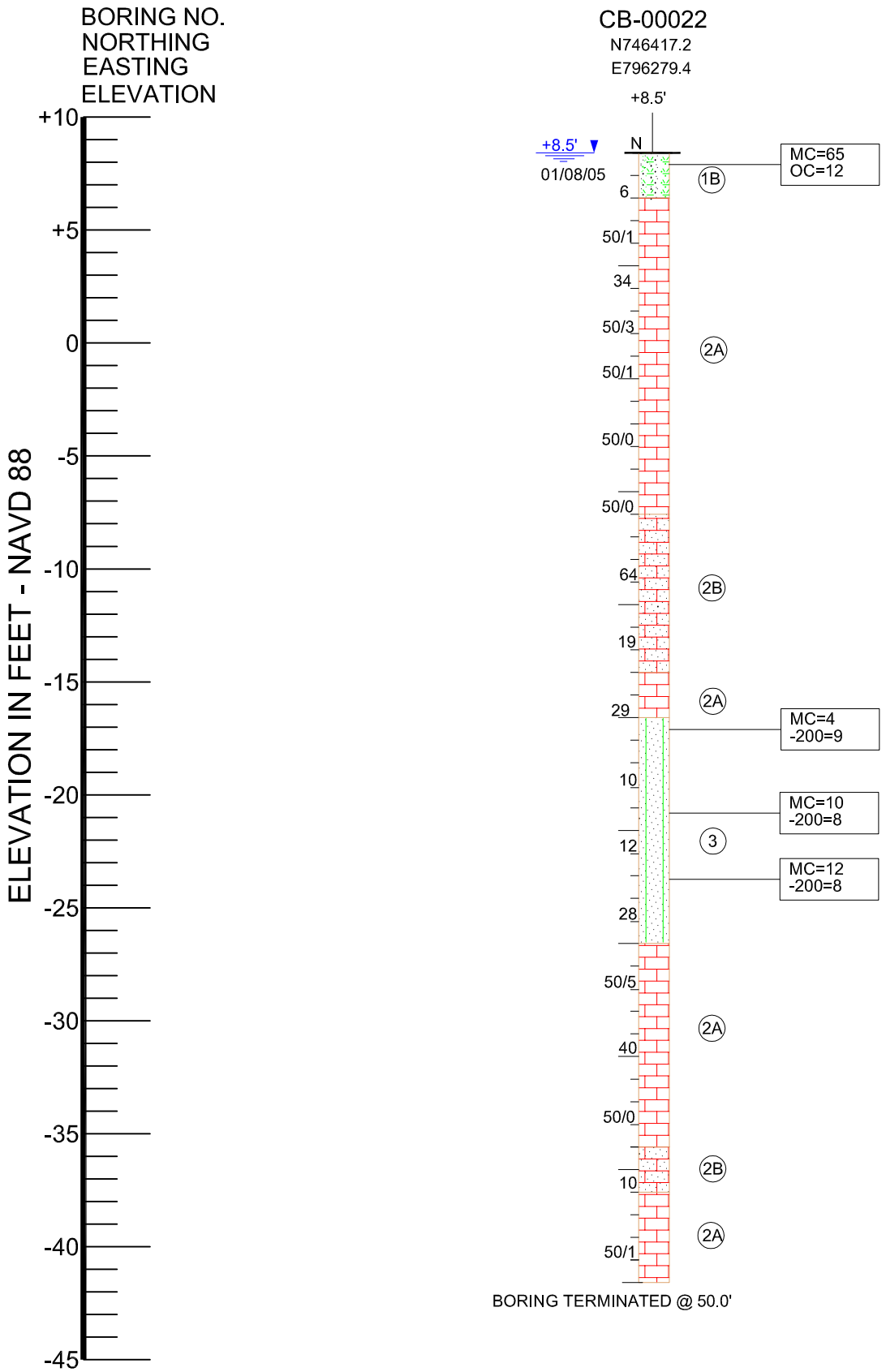

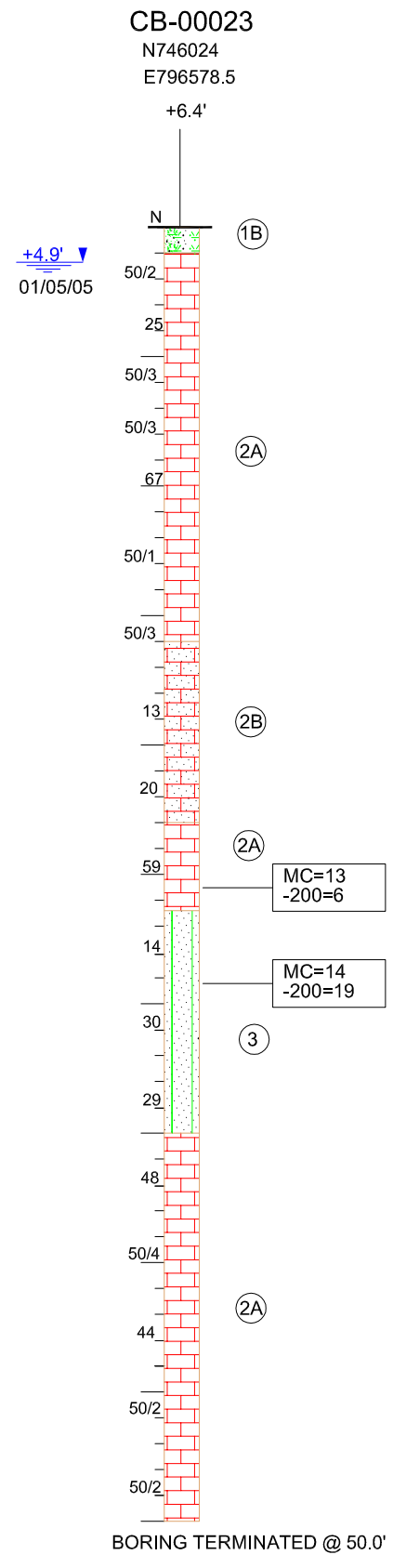

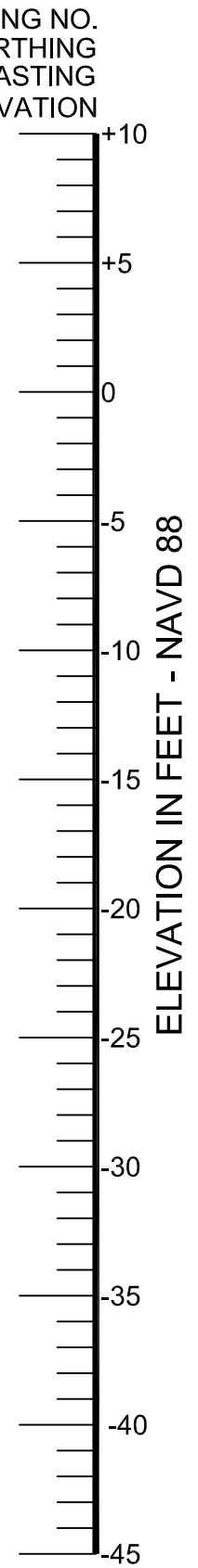

LEGEND

1A	DARK BROWN FIBROUS PEAT WITH TRACES TRACES OF ORGANIC SILT AND CLAY (PT)
1B	DARK BROWN ORGANIC SILT AND CLAY WITH SOME FIBROUS PEAT (PT)
2A	GRAY, BROWN AND TAN LIMESTONE
2B	GRAY TO TAN SILTY TO SLIGHTLY SILTY CALCAREOUS SAND (SM) AND LIMESTONE SEAMS AND SHELL
3	GRAY, GREEN SLIGHTLY SILTY TO SILTY FINE SAND WITH LIMESTONE SEAMS AND SHELL (SP-SM)(SM)
N	STANDARD PENETRATION RESISTANCE (BLOWS PER FOOT)
50/1	INDICATES THAT 50 BLOWS ARE REQUIRED TO DRIVE SAMPLER 1 INCH

STANDARD PENETRATION TEST DATA

SPOON INSIDE DIA.	1.375 INCH
SPOON OUTSIDE DIA.	2.0 INCHES
AVG. HAMMER DROP	30 INCHES
HAMMER WEIGHT	140 POUNDS

+8.5' ▼ 01/08/05	GROUNDWATER ELEVATION FEET- NAVD 88 ON THE DRILLING DATE
N746417.2 E796279.4	NORTHING AND EASTING ARE REFERENCED TO NORTH AMERICAN VERTICAL DATUM OF 1988 AND EXPRESSED IN FEET, OBTAINED FROM PROJECT SURVEYOR
NR	NOT RECORDED
REC	CORE RECOVERY (%)
RQD	ROCK QUALITY DESIGNATION (%)
PT	UNIFIED SOIL CLASSIFICATION SYSTEM GROUP SYMBOL (ASTM D 2487)
MC	NATURAL MOISTURE CONTENT (%)
OC	ORGANIC CONTENT (%)
-200	AMOUNT PASSING U.S. No. 200 SIEVE (%)

NOTES

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Date.	By	Descriptions	Date.	By	Descriptions	

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SOUTH FLORIDA WATER MANAGEMENT DISTRICT

COUNTY	CONTRACT NO
PALM BEACH	CN040935

SCALE: VERTICAL 1" = 7'

SCALE: HORIZONTAL N/A

SHEET TITLE: SUBSURFACE PROFILES

PROJECT NAME: STA 2/CELL 4 EXPANSION PROJECT
PALM BEACH COUNTY
FLORIDA

SHEET NO. 5 F

RADISE PROJECT NO: 04/RB/GEOT/0701

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SPT BORING PROFILES

DRILLING LOG

HOLE NUMBER: CP04-STA2N-CB-00001

1. PROJECT: STA-2/ Cell 4 Ehancement Project	10. SIZE AND TYPE OF BIT:
2. COORDINATES: North: 758565 East: 801498.6	11. DATUM FOR ELEVATION SHOWN: NAVD 1988
3. DRILLING AGENCY: RADISE International	12. MANUFACTURER'S DESIGNATION OF DRILL:
4. RADISE PROJECT NUMBER: 04/RB/Geot/0701 A	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 10, UNDISTURBED 0
5. NAME OF DRILLER: MP/AR	14. TOTAL NUMBER CORE BOXES: 0
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED 90 DEG. FROM HORZ.	15. STANDING WATER: +0.1 ft
7. THICKNESS OF OVERBURDEN: 1 ft	16. DATE HOLE: STARTED 1/4/2005, COMPLETED 1/4/2005
8. DEPTH DRILLED INTO ROCK: 24 ft	17. ELEVATION TOP OF HOLE: 7.3 ft
9. TOTAL DEPTH OF HOLE: 25 ft	18. TOTAL CORE RECOVERY FOR BORING: N/A %
	19. GEOLOGIST/ENGINEERS REPRESENTATIVE: JT

ELEV. a	DEPTH b	LEGEND c	USCS d	CLASSIFICATION OF MATERIALS (Description) e	SAMPLE TYPE f	SAMPLE NO. g	BLOWS/ 6 INCHES h	PENETRATION RESISTANCE (N) i (0 20 40 60 80 100)	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) j
+7.3	0.0		PT	Dark Brown organic silt and clay with some fibrous peat					
+6.3	1			Gray, Brown and Tan Limestone		S-1	3-5-19-50/5		**Depth - 0' - 2'** MC - 30% OC - 29%
						S-2	50/5		
						S-3	7-17-36-50/3		**Drilling Time:** **Feet — Min. : Sec.** 0 - 1 0:15 1 - 2 4:25 2 - 3 0:45 3 - 4 1:30 4 - 5 2:50 5 - 6 3:45 6 - 7 2:45 7 - 8 1:38 8 - 9 1:50 9 - 10 1:20 10 - 11 0:58 11 - 12 1:10 12 - 13 0:38 13 - 14 0:20 14 - 15 0:20 15 - 16 0:33 16 - 17 0:38 17 - 18 0:20 18 - 19 0:20 19 - 20 0:20 20 - 21 0:22 21 - 22 0:20 22 - 23 0:20
						S-4	50/1		
						S-5	50/1		
-2.7	10			Gray to Tan silty to slightly silty calcareous sand (SM) and limestone seams and shell					
						S-6	11-7-14-12		
						S-7	6-5-4-4		
						S-8	10-2-3-6		
						S-9	16-17-10-11		**Note:** 1. 50/5 - Indicates that the 50 blows were required to penetrate sampler 5 inches 2. Down Pressure 100 psi 3. No circulation loss was observed during drilling 4. MC - Natural Moisture Content 5. OC - Organic Content
-17.7	25					S-10	3-5-5-7		

Peat ▨ Limestone ▨ Calcareous Sand and Limestone Seams

Sample Type ☒ SPT SAMPLE

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SHEET 1 OF 1

c:\program files\gint\projects\sta-2.gpj

DRILLING LOG

HOLE NUMBER: CP04-STA2N-CB-00003

1. PROJECT: STA-2/ Cell 4 Ehancement Project	10. SIZE AND TYPE OF BIT
2. COORDINATES: North: 755600.8 East: 801520.9	11. DATUM FOR ELEVATION SHOWN: NAVD 1988
3. DRILLING AGENCY: RADISE International	12. MANUFACTURER'S DESIGNATION OF DRILL
4. RADISE PROJECT NUMBER: 04/RB/Geot/0701 A	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 10, UNDISTURBED 0
5. NAME OF DRILLER: MP/AR	14. TOTAL NUMBER CORE BOXES: 0
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED 90 DEG. FROM HORZ.	15. STANDING WATER: +0.1 ft
7. THICKNESS OF OVERBURDEN: 1 ft	16. DATE HOLE: STARTED 1/4/2005, COMPLETED 1/4/2005
8. DEPTH DRILLED INTO ROCK: 24 ft	17. ELEVATION TOP OF HOLE: 7.3 ft
9. TOTAL DEPTH OF HOLE: 25 ft	18. TOTAL CORE RECOVERY FOR BORING: N/A %
	19. GEOLOGIST/ENGINEERS REPRESENTATIVE: JT

ELEV. a	DEPTH b	LEGEND c	USCS d	CLASSIFICATION OF MATERIALS (Description) e	SAMPLE TYPE f	SAMPLE NO. g	BLOWS/ 6 INCHES h	PENETRATION RESISTANCE (N) i (0 20 40 60 80 100)	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) j
+7.3	0.0		PT	Dark Brown organic silt and clay with some fibrous peat					**Depth - 0' - 2'** MC - 123% OC - 41%
+6.3	1			Gray, Brown and Tan Limestone		S-1	2-2-11-4	>>	
						S-2	11-50/4	>>	
						S-3	50/5	>>	**Drilling Time:**
						S-4	12-50/1	>>	Feet / Min. : Sec.
						S-5	50/2	>>	0 - 1 0:15
									1 - 2 0:20
						S-6	21-50/3	>>	2 - 3 0:20
									3 - 4 3:10
						S-7	50/1	>>	4 - 5 3:15
-8.7	16								5 - 6 2:50
				Gray to Tan silty to slightly silty calcareous sand (SM) and limestone seams and shell					6 - 7 2:20
						S-8	6-4-2-2		7 - 8 2:10
-12.7	20								8 - 9 2:50
				Gray, Brown and Tan Limestone		S-9	21-20-10-8		9 - 10 2:10
-14.7	22								10 - 11 2:50
				Gray to Tan silty to slightly silty calcareous sand (SM) and limestone seams and shell		S-10	6-7-7-9		11 - 12 1:28
-17.7	25								12 - 13 1:43
									13 - 14 1:15
									14 - 15 1:00
									15 - 16 0:15
									16 - 17 0:25
									17 - 18 0:20
									18 - 19 0:22
									19 - 20 0:18
									20 - 21 0:20
									21 - 22 0:15
									22 - 23 0:15

Note:
1. 50/3 - Indicates that the 50 blows were required to penetrate sampler 3 inches
2. Down Pressure 100 psi
3. No circulation loss was observed during drilling
4. MC - Natural Moisture Content
5. OC - Organic Content

Peat | Limestone | Calcareous Sand and Limestone Seams

Sample Type ☒ SPT SAMPLE

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SHEET 1 OF 1

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DRILLING LOG

HOLE NUMBER: CP04-STA2N-CB-00005

1. PROJECT: STA-2/ Cell 4 Ehancement Project
2. COORDINATES: North: 753686.4 East: 790659.1
3. DRILLING AGENCY: RADISE International
4. RADISE PROJECT NUMBER: 04/RB/Geot/0701 A
5. NAME OF DRILLER: MP/AR
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED 90 DEG. FROM HORZ.
7. THICKNESS OF OVERBURDEN: 2 ft
8. DEPTH DRILLED INTO ROCK: 23 ft
9. TOTAL DEPTH OF HOLE: 25 ft
10. SIZE AND TYPE OF BIT:
11. DATUM FOR ELEVATION SHOWN: NAVD 1988
12. MANUFACTURER'S DESIGNATION OF DRILL:
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 10 UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES: 0
15. STANDING WATER: +1 ft
16. DATE HOLE: STARTED 1/9/2005 COMPLETED 1/10/2005
17. ELEVATION TOP OF HOLE: 8.1 ft
18. TOTAL CORE RECOVERY FOR BORING: N/A %
19. GEOLOGIST/ENGINEERS REPRESENTATIVE: JT

ELEV. a	DEPTH b	LEGEND c	USCS d	CLASSIFICATION OF MATERIALS (Description) e	SAMPLE TYPE f	SAMPLE NO. g	BLOWS/ 6 INCHES h	PENETRATION RESISTANCE (N) i (0 20 40 60 80 100)	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) j
+8.1	0.0		PT	Dark Brown fibrous peat with traces of organic silt and clay		S-1	1-1-1-1		**Depth - 0' - 2'** MC - 170% OC - 65%
+6.1	2			Gray, Brown and Tan Limestone		S-2	50/1	>>	
						S-3	21-50/1	>>	**Drilling Time:**
						S-4	50/1	>>	Feet / Min. : Sec. 0 - 1 0:10 1 - 2 0:10 2 - 3 11:38 3 - 4 9:15 4 - 5 4:10 5 - 6 3:00
						S-5	50/0	>>	6 - 7 8:16 7 - 8 7:30 8 - 9 3:20 9 - 10 1:10 10 - 11 0:55
						S-6	50/5	>>	11 - 12 1:20 12 - 13 1:30 13 - 14 0:15 14 - 15 0:20 15 - 16 0:20 16 - 17 0:25 17 - 18 0:32
-5.9	14			Gray to Tan silty to slightly silty calcareous sand (SM) and limestone seams and shell		S-7	18-7-5-5		18 - 19 0:25 19 - 20 0:15 20 - 21 0:15 21 - 22 0:20 22 - 23 0:25
-8.9	17			Gray, Brown and Tan Limestone		S-8	17-15-19-22		
-10.9	19			Gray to Tan silty to slightly silty calcareous sand (SM) and limestone seams and shell		S-9	12-9-8-6		**Note:** 1. 50/1 - Indicates that the 50 blows were required to penetrate sampler 1 inche 2. Down Pressure 100 psi 3. No circulation loss was observed during drilling 4. MC - Natural Moisture Content 5. OC - Organic Content
-16.9	25					S-10	9-7-4-8		

Peat ▨ Limestone ▨ Calcareous Sand and Limestone Seams

Sample Type ☒ SPT SAMPLE

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SHEET 1 OF 1

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DRILLING LOG

HOLE NUMBER: CP04-STA2N-CB-00006

1. PROJECT: STA-2/ Cell 4 Ehancement Project	10. SIZE AND TYPE OF BIT
2. COORDINATES: North: 753602.3 East: 791675.7	11. DATUM FOR ELEVATION SHOWN: NAVD 1988
3. DRILLING AGENCY: RADISE International	12. MANUFACTURER'S DESIGNATION OF DRILL
4. RADISE PROJECT NUMBER: 04/RB/Geot/0701 A	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 10, UNDISTURBED 0
5. NAME OF DRILLER: MP/AR	14. TOTAL NUMBER CORE BOXES: 0
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED 90 DEG. FROM HORZ.	15. STANDING WATER: +0 ft
7. THICKNESS OF OVERBURDEN: 1 ft	16. DATE HOLE: STARTED 1/9/2005, COMPLETED 1/9/2005
8. DEPTH DRILLED INTO ROCK: 24 ft	17. ELEVATION TOP OF HOLE: 7.4 ft
9. TOTAL DEPTH OF HOLE: 25 ft	18. TOTAL CORE RECOVERY FOR BORING: N/A %
	19. GEOLOGIST/ENGINEERS REPRESENTATIVE: JT

ELEV. a	DEPTH b	LEGEND c	USCS d	CLASSIFICATION OF MATERIALS (Description) e	SAMPLE TYPE f	SAMPLE NO. g	BLOWS/ 6 INCHES h	PENETRATION RESISTANCE (N) i	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) j
+7.4	0.0		PT	Dark Brown organic silt and clay with some fibrous peat		S-1	1-1-50/1		**Depth - 0' - 2'** MC - 73% OC - 82%
+6.4	1			Gray, Brown and Tan Limestone		S-2	50/0		
						S-3	49-50/3		**Drilling Time:** **Feet** **Min. : Sec.** 0 - 1 0:10 1 - 2 0:10 2 - 3 11:20 3 - 4 11:40 4 - 5 7:30 5 - 6 5:45 6 - 7 2:20 7 - 8 7:15 8 - 9 1:10 9 - 10 1:05 10 - 11 0:45 11 - 12 0:38 12 - 13 1:10 13 - 14 0:40 14 - 15 0:35 15 - 16 0:28 16 - 17 0:25 17 - 18 0:25 18 - 19 1:10 19 - 20 0:28 20 - 21 1:10 21 - 22 0:55 22 - 23 0:58
						S-4	50/3		
						S-5	12-10-15-18		
						S-6	17-40-26-10		
-6.6	14			Gray to Tan silty to slightly silty calcareous sand (SM) and limestone seams and shell		S-7	16-6-5-3		
						S-8	16-7-9-15		
						S-9	14-10-8-8		**Note:** 1. 50/0 - Indicates that the 50 blows were required to penetrate sampler 0 inch 2. Down Pressure 100 psi 3. No circulation loss was observed during drilling 4. MC - Natural Moisture Content 5. OC - Organic Content
-17.6	25					S-10	8-8-9-12		

PENETRATION RESISTANCE (N) scale: 0 20 40 60 80 100

Peat ▨ Limestone ▨ Calcareous Sand and Limestone Seams

Sample Type ☒ SPT SAMPLE

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DRILLING LOG

HOLE NUMBER: CP04-STA2N-CB-00007

1. PROJECT: STA-2/ Cell 4 Ehancement Project	10. SIZE AND TYPE OF BIT
2. COORDINATES: North: 753804.1 East: 793342.5	11. DATUM FOR ELEVATION SHOWN: NAVD 1988
3. DRILLING AGENCY: RADISE International	12. MANUFACTURER'S DESIGNATION OF DRILL
4. RADISE PROJECT NUMBER: 04/RB/Geot/0701 A	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 10, UNDISTURBED 0
5. NAME OF DRILLER: MP/AR	14. TOTAL NUMBER CORE BOXES: 0
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED 90 DEG. FROM HORZ.	15. STANDING WATER: +0.5 ft
7. THICKNESS OF OVERBURDEN: 1 ft	16. DATE HOLE: STARTED 1/10/2005, COMPLETED 1/11/2005
8. DEPTH DRILLED INTO ROCK: 24 ft	17. ELEVATION TOP OF HOLE: 7.4 ft
9. TOTAL DEPTH OF HOLE: 25 ft	18. TOTAL CORE RECOVERY FOR BORING: N/A %
	19. GEOLOGIST/ENGINEERS REPRESENTATIVE: JT

ELEV. a	DEPTH b	LEGEND c	USCS d	CLASSIFICATION OF MATERIALS (Description) e	SAMPLE TYPE f	SAMPLE NO. g	BLOWS/ 6 INCHES h	PENETRATION RESISTANCE (N) 0 20 40 i 60 80 100	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) j
+7.4	0.0		PT	Dark Brown organic silt and clay with some fibrous peat					**Depth - 0' - 2'**
+6.4	1			Gray, Brown and Tan Limestone		S-1	5-50/0	>>	
						S-2	50/0	>>	
						S-3	41-15-50/0	>>	
						S-4	50/1	>>	
						S-5	50/5	>>	
						S-6	12-50/0	>>	
-6.6	14			Gray to Tan silty to slightly silty calcareous sand (SM) and limestone seams and shell		S-7	7-6-5-6		
						S-8	7-7-10-52		
-12.6	20			Gray, Brown and Tan Limestone		S-9	7-10-27-29		
-14.6	22			Gray to Tan silty to slightly silty calcareous sand (SM) and limestone seams and shell					
-17.6	25					S-10	10-11-10-18		

Drilling Time:

Feet	Min. : Sec.
0 - 1	1:38
1 - 2	3:40
2 - 3	3:55
3 - 4	3:15
4 - 5	7:48
5 - 6	6:55
6 - 7	2:38
7 - 8	0:20
8 - 9	2:38
9 - 10	1:20
10 - 11	1:25
11 - 12	1:10
12 - 13	0:55
13 - 14	0:28
14 - 15	0:20
15 - 16	0:20
16 - 17	0:35
17 - 18	0:20
18 - 19	0:40
19 - 20	0:35
20 - 21	0:23
21 - 22	0:20
22 - 23	0:20

Note:
1. 50/0 - Indicates that the 50 blows were required to penetrate sampler 0 inch
2. Down Pressure 100 psi
3. No circulation loss was observed during drilling

Peat ▨ Limestone ▨ Calcareous Sand and Limestone Seams

Sample Type ☒ SPT SAMPLE

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SHEET 1 OF 1

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DRILLING LOG

HOLE NUMBER: CP04-STA2N-CB-00010

1. PROJECT: STA-2/ Cell 4 Ehancement Project	10. SIZE AND TYPE OF BIT:
2. COORDINATES: North: 753733.1 East: 796972.5	11. DATUM FOR ELEVATION SHOWN: NAVD 1988
3. DRILLING AGENCY: RADISE International	12. MANUFACTURER'S DESIGNATION OF DRILL:
4. RADISE PROJECT NUMBER: 04/RB/Geot/0701 A	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN — DISTURBED: N/A; UNDISTURBED: N/A
5. NAME OF DRILLER: MP/AR	14. TOTAL NUMBER CORE BOXES: 2
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED 90 DEG. FROM HORZ.	15. STANDING WATER: +0.5 ft
7. THICKNESS OF OVERBURDEN: 1 ft	16. DATE HOLE — STARTED: 12/27/2004; COMPLETED: 12/27/2004
8. DEPTH DRILLED INTO ROCK: 24 ft	17. ELEVATION TOP OF HOLE: 8.2 ft
9. TOTAL DEPTH OF HOLE: 25 ft	18. TOTAL CORE RECOVERY FOR BORING: N/A %
	19. GEOLOGIST/ENGINEERS REPRESENTATIVE: JT

ELEV. a	DEPTH b	LEGEND c	USCS d	CLASSIFICATION OF MATERIALS (Description) e	SAMPLE TYPE f	SAMPLE NO. g	BLOWS/ 6 INCHES h	PENETRATION RESISTANCE (N) i (0 20 40 60 80 100)	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) j
+8.2	0.0		PT	Dark Brown organic silt and clay with some fibrous peat					
+7.2	1			Gray, Brown and Tan Limestone		S-1	1-3-17-39		
						S-2	5-7-29-37		
						S-3	29-50/2	>>	
						S-4	50/2		
						S-5	50/1	>>	
						S-6	47-50/1	>>	
-7.8	16					S-7	17-19-50/1	>>	
				Gray to Tan silty to slightly silty calcareous sand (SM) and limestone seams and shell					
						S-8	10-8-7-7		
-11.8	20								
				Gray, Brown and Tan Limestone		S-9	14-17-31-55		
						S-10	15-21-9-7		
-16.8	25								

Drilling Time:

Feet	Min. : Sec.
0 - 1	0:10
1 - 2	0:15
2 - 3	0:15
3 - 4	0:20
4 - 5	1:48
5 - 6	3:28
6 - 7	3:45
7 - 8	1:58
8 - 9	2:35
9 - 10	2:30
10 - 11	1:30
11 - 12	1:58
12 - 13	2:20
13 - 14	1:38
14 - 15	1:00
15 - 16	1:10
16 - 17	1:05
17 - 18	0:28
18 - 19	1:10
19 - 20	1:10
20 - 21	0:15
21 - 22	0:20
22 - 23	0:25

Note:
1. 50/2 - Indicates that the 50 blows were required to penetrate sampler 5 inches
2. Down Pressure 100 psi
3. No circulation loss was observed during drilling

Peat ▨ Limestone ▨ Calcareous Sand and Limestone Seams

Sample Type ☒ SPT SAMPLE

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DRILLING LOG

HOLE NUMBER: CP04-STA2N-CB-00011

1. PROJECT: STA-2/ Cell 4 Ehancement Project
2. COORDINATES: North: 753801.5 East: 799271.8
3. DRILLING AGENCY: RADISE International
4. RADISE PROJECT NUMBER: 04/RB/Geot/0701 A
5. NAME OF DRILLER: MP/AR
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED 90 DEG. FROM HORZ.
7. THICKNESS OF OVERBURDEN: 2 ft
8. DEPTH DRILLED INTO ROCK: 23 ft
9. TOTAL DEPTH OF HOLE: 25 ft
10. SIZE AND TYPE OF BIT:
11. DATUM FOR ELEVATION SHOWN: NAVD 1988
12. MANUFACTURER'S DESIGNATION OF DRILL:
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 10 UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES: 0
15. STANDING WATER: +0 ft
16. DATE HOLE: STARTED 12/23/2004 COMPLETED 12/23/2004
17. ELEVATION TOP OF HOLE: 8.2 ft
18. TOTAL CORE RECOVERY FOR BORING: N/A %
19. GEOLOGIST/ENGINEERS REPRESENTATIVE: JT

ELEV. a	DEPTH b	LEGEND c	USCS d	CLASSIFICATION OF MATERIALS (Description) e	SAMPLE TYPE f	SAMPLE NO. g	BLOWS/ 6 INCHES h
+8.2	0.0		PT	Dark Brown organic silt and clay with some fibrous peat		S-1	1-1-1-1
+6.2	2			Gray, Brown and Tan Limestone		S-2	50/5
						S-3	5-6-16-50/1
						S-4	50/5
						S-5	10-11-50/2
						S-6	8-10-12-50/1
						S-7	50/5
-7.8	16			Gray to Tan silty to slightly silty calcareous sand (SM) and limestone seams and shell		S-8	7-7-10-8
-11.8	20			Gray, Brown and Tan Limestone		S-9	12-13-13-20
						S-10	8-20-18-20
-16.8	25						

PENETRATION RESISTANCE (N): 0 20 40 60 80 100

REMARKS (*Drilling time, water loss, depth weathering, etc., if significant*)

Depth - 0' - 2'
MC - 27%
OC - 82%

Drilling Time:

Feet	Min. : Sec.
0 - 1	0:05
1 - 2	0:05
2 - 3	2:50
3 - 4	2:45
4 - 5	1:10
5 - 6	6:10
6 - 7	1:48
7 - 8	7:45
8 - 9	3:20
9 - 10	3:45
10 - 11	2:30
11 - 12	1:40
12 - 13	1:30
13 - 14	2:32
14 - 15	1:20
15 - 16	0:50
16 - 17	1:10
17 - 18	1:20
18 - 19	1:25
19 - 20	0:38
20 - 21	1:10
21 - 22	0:58
22 - 23	0:45

Note:
1. 50/5 - Indicates that the 50 blows were required to penetrate sampler 5 inches
2. Down Pressure 100 psi
3. No circulation loss was observed during drilling
4. MC - Natural Moisture Content
5. OC - Organic Content

Peat | Limestone | Calcareous Sand and Limestone Seams

Sample Type ☒ SPT SAMPLE

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SHEET 1 OF 1

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DRILLING LOG

HOLE NUMBER: CP04-STA2N-CB-00014

1. PROJECT: STA-2/ Cell 4 Ehancement Project	10. SIZE AND TYPE OF BIT:
2. COORDINATES: North: 743320 East: 798935.2	11. DATUM FOR ELEVATION SHOWN: NAVD 1988
3. DRILLING AGENCY: RADISE International	12. MANUFACTURER'S DESIGNATION OF DRILL:
4. RADISE PROJECT NUMBER: 04/RB/Geot/0701 A	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 10, UNDISTURBED 0
5. NAME OF DRILLER: MP/AR	14. TOTAL NUMBER CORE BOXES: 0
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED 90 DEG. FROM HORZ.	15. STANDING WATER: +0.5 ft
7. THICKNESS OF OVERBURDEN: 1 ft	16. DATE HOLE: STARTED 12/20/2004, COMPLETED 12/20/2004
8. DEPTH DRILLED INTO ROCK: 24 ft	17. ELEVATION TOP OF HOLE: 8.3 ft
9. TOTAL DEPTH OF HOLE: 25 ft	18. TOTAL CORE RECOVERY FOR BORING: N/A %
	19. GEOLOGIST/ENGINEERS REPRESENTATIVE: JT

ELEV. a	DEPTH b	LEGEND c	USCS d	CLASSIFICATION OF MATERIALS (Description) e	SAMPLE TYPE f	SAMPLE NO. g	BLOWS/ 6 INCHES h	PENETRATION RESISTANCE (N) i (0 20 40 60 80 100)	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) j
+8.3	0.0		PT	Dark Brown organic silt and clay with some fibrous peat					**Depth - 0' - 2'** MC - 135% OC - 55%
+7.3	1			Gray, Brown and Tan Limestone		S-1	3-4-18-16		
						S-2	22-50/5		
						S-3	50/3		**Drilling Time:**
						S-4	50/5		Feet / Min. : Sec.
						S-5	50/1		0 - 1 0:20
									1 - 2 0:35
						S-6	50/3		2 - 3 0:35
									3 - 4 1:20
						S-7	50/1		4 - 5 1:35
-7.7	16								5 - 6 1:50
				Gray to Tan silty to slightly silty calcareous sand (SM) and limestone seams and shell		S-8	4-5-6-5		6 - 7 1:20
-11.7	20								7 - 8 0:45
				Gray, Brown and Tan Limestone		S-9	20-50/5		8 - 9 0:49
									9 - 10 0:40
						S-10	4-14-13-11		10 - 11 0:56
-16.7	25								11 - 12 1:44
									12 - 13 9:08
									13 - 14 0:25
									14 - 15 0:48
									15 - 16 3:34
									16 - 17 0:15
									17 - 18 0:15
									18 - 19 0:18
									19 - 20 0:23
									20 - 21 1:00
									21 - 22 0:45
									22 - 23 0:46

Note:
1. 50/5 - Indicates that the 50 blows were required to penetrate sampler 5 inches
2. Down Pressure 100 psi
3. No circulation loss was observed during drilling
4. MC - Natural Moisture Content
5. OC - Organic Content

Peat | Limestone | Calcareous Sand and Limestone Seams

Sample Type ☒ SPT SAMPLE

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DRILLING LOG

HOLE NUMBER: CP04-STA2N-CB-00016

1. PROJECT: STA-2/ Cell 4 Ehancement Project	10. SIZE AND TYPE OF BIT
2. COORDINATES: North: 743329.1 East: 800917.9	11. DATUM FOR ELEVATION SHOWN: NAVD 1988
3. DRILLING AGENCY: RADISE International	12. MANUFACTURER'S DESIGNATION OF DRILL
4. RADISE PROJECT NUMBER: 04/RB/Geot/0701 A	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 10, UNDISTURBED 0
5. NAME OF DRILLER: MP/AR	14. TOTAL NUMBER CORE BOXES: 0
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED 90 DEG. FROM HORZ.	15. STANDING WATER: +0 ft
7. THICKNESS OF OVERBURDEN: 2 ft	16. DATE HOLE: STARTED 12/20/2004, COMPLETED 12/20/2004
8. DEPTH DRILLED INTO ROCK: 23 ft	17. ELEVATION TOP OF HOLE: 8.1 ft
9. TOTAL DEPTH OF HOLE: 25 ft	18. TOTAL CORE RECOVERY FOR BORING: N/A %
	19. GEOLOGIST/ENGINEERS REPRESENTATIVE: JT

ELEV. a	DEPTH b	LEGEND c	USCS d	CLASSIFICATION OF MATERIALS (Description) e	SAMPLE TYPE f	SAMPLE NO. g	BLOWS/ 6 INCHES h	PENETRATION RESISTANCE (N) i	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) j
+8.1	0.0		PT	Dark Brown organic silt and clay with some fibrous peat		S-1	2-3-4-4		**Depth - 0' - 2'** MC - 126% OC - 52%
+6.1	2			Gray, Brown and Tan Limestone		S-2	50/5	>>	
						S-3	50/5	>>	**Drilling Time:**
						S-4	50/2	>>	**Feet / Min. : Sec.** 0 - 1 0:05 1 - 2 0:20 2 - 3 3:25 3 - 4 2:05 4 - 5 1:40 5 - 6 3:30 6 - 7 2:50 7 - 8 3:30 8 - 9 1:10 9 - 10 2:50 10 - 11 1:20 11 - 12 1:00 12 - 13 1:28 13 - 14 1:04 14 - 15 0:40 15 - 16 0:37 16 - 17 0:50 17 - 18 0:50 18 - 19 1:05 19 - 20 1:40 20 - 21 0:49 21 - 22 0:55 22 - 23 0:50
						S-5	13-29-17-50/3		
-4.9	13					S-6	8-17-18-50/4		
				Gray to Tan silty to slightly silty calcareous sand (SM) and limestone seams and shell					
						S-7	2-2-2-4		
-8.9	17							>>	
-10.9	19			Gray, Brown and Tan Limestone		S-8	50/3		
				Gray to Tan silty to slightly silty calcareous sand (SM) and limestone seams and shell					
						S-9	16-5-10-12		**Note:** 1. 50/5 - Indicates that the 50 blows were required to penetrate sampler 5 inches 2. Down Pressure 100 psi 3. No circulation loss was observed during drilling 4. MC - Natural Moisture Content 5. OC - Organic Content
-14.9	23								
-16.9	25			Gray, Brown and Tan Limestone		S-10	37-22-24-22		

Peat | Limestone | Calcareous Sand and Limestone Seams

Sample Type ☒ SPT SAMPLE

RADISE Infrastructure Engineers • Software Developers

SHEET 1 OF 1

c:\program files\gint\projects\sta-2.gpj

DRILLING LOG

HOLE NUMBER: CP04-STA2N-CB-00018

1. PROJECT: STA-2/ Cell 4 Ehancement Project	10. SIZE AND TYPE OF BIT
2. COORDINATES: North: 743267.3 East: 806847.8	11. DATUM FOR ELEVATION SHOWN: NAVD 1988
3. DRILLING AGENCY: RADISE International	12. MANUFACTURER'S DESIGNATION OF DRILL
4. RADISE PROJECT NUMBER: 04/RB/Geot/0701 A	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 10, UNDISTURBED 0
5. NAME OF DRILLER: MP/AR	14. TOTAL NUMBER CORE BOXES: 0
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED 90 DEG. FROM HORZ.	15. STANDING WATER: +0.5 ft
7. THICKNESS OF OVERBURDEN: 2 ft	16. DATE HOLE: STARTED 12/18/2004, COMPLETED 12/18/2004
8. DEPTH DRILLED INTO ROCK: 23 ft	17. ELEVATION TOP OF HOLE: 8.3 ft
9. TOTAL DEPTH OF HOLE: 25 ft	18. TOTAL CORE RECOVERY FOR BORING: N/A %
	19. GEOLOGIST/ENGINEERS REPRESENTATIVE: JT

ELEV. a	DEPTH b	LEGEND c	USCS d	CLASSIFICATION OF MATERIALS (Description) e	SAMPLE TYPE f	SAMPLE NO. g	BLOWS/ 6 INCHES h	PENETRATION RESISTANCE (N) i	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) j
+8.3	0.0		PT	Dark Brown organic silt and clay with some fibrous peat			2-2-6-8		**Depth - 0' - 2'** MC - 130% OC - 50%
+6.3	2			Gray, Brown and Tan Limestone			50/5		
							2-9-50/3		**Drilling Time:**
							28-50/2		**Feet / Min. : Sec.** 0 - 1 0:05 1 - 2 0:05 2 - 3 1:15 3 - 4 9:18 4 - 5 0:28 5 - 6 1:50 6 - 7 1:25 7 - 8 2:07 8 - 9 0:40 9 - 10 1:40 10 - 11 2:55 11 - 12 0:40 12 - 13 0:48 13 - 14 2:00 14 - 15 1:45 15 - 16 1:15 16 - 17 0:28 17 - 18 0:15 18 - 19 0:30 19 - 20 0:48 20 - 21 0:20 21 - 22 0:18
							36-50/4		
							30-21-48-50/2		
-7.7	16						14-13-5-50/2		
				Gray to Tan silty to slightly silty calcareous sand (SM) and limestone seams and shell			4-3-4-3		
							14-6-13-45		**Note:** 1. 50/5 - Indicates that the 50 blows were required to penetrate sampler 5 inches 2. Down Pressure 100 psi 3. No circulation loss was observed during drilling 4. MC - Natural Moisture Content 5. OC - Organic Content
-13.7	22								
				Gray, Brown and Tan Limestone			20-20-21-16		
-16.7	25								

Peat ▨ Limestone ▨ Calcareous Sand and Limestone Seams

Sample Type ☒ SPT SAMPLE

RADISE Infrastructure Engineers • Software Developers

SHEET 1 OF 1

c:\program files\gint\projects\sta-2.gpj

DRILLING LOG

HOLE NUMBER: CP04-STA2N-CB-00020

1. PROJECT: STA-2/ Cell 4 Ehancement Project	10. SIZE AND TYPE OF BIT
2. COORDINATES: North: 743280.7 East: 808981.4	11. DATUM FOR ELEVATION SHOWN: NAVD 1988
3. DRILLING AGENCY: RADISE International	12. MANUFACTURER'S DESIGNATION OF DRILL
4. RADISE PROJECT NUMBER: 04/RB/Geot/0701 A	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 10, UNDISTURBED 0
5. NAME OF DRILLER: MP/AR	14. TOTAL NUMBER CORE BOXES: 0
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED 90 DEG. FROM HORZ.	15. GROUNDWATER DEPTH: 0.5 ft
7. THICKNESS OF OVERBURDEN: 2 ft	16. DATE HOLE: STARTED 12/16/2004, COMPLETED 12/16/2004
8. DEPTH DRILLED INTO ROCK: 23 ft	17. ELEVATION TOP OF HOLE: 8.1 ft
9. TOTAL DEPTH OF HOLE: 25 ft	18. TOTAL CORE RECOVERY FOR BORING: N/A %
	19. GEOLOGIST/ENGINEERS REPRESENTATIVE: JT

ELEV. a	DEPTH b	LEGEND c	USCS d	CLASSIFICATION OF MATERIALS (Description) e	SAMPLE TYPE f	SAMPLE NO. g	BLOWS/ 6 INCHES h	PENETRATION RESISTANCE (N) i	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) j
+8.1	0.0		PT	Dark Brown organic silt and clay with some fibrous peat		S-1	1-3-7-24		**Depth - 0' - 2'** MC - 180% OC - 68%
+6.1	2			Gray, Brown and Tan Limestone			50/2		
						S-2	9-4-8-26		**Drilling Time:** **Feet** **Min. : Sec.** 0 - 1 0:05 1 - 2 1:30 2 - 3 0:50 3 - 4 0:55 4 - 5 2:20 5 - 6 2:38 6 - 7 2:50 7 - 8 3:20 8 - 9 2:40 9 - 10 1:58 10 - 11 2:13 11 - 12 2:20 12 - 13 1:55 13 - 14 1:48 14 - 15 0:32 15 - 16 0:40 16 - 17 0:21 17 - 18 0:22 18 - 19 0:20 19 - 20 0:42 20 - 21 0:40 21 - 22 0:35 22 - 23 0:38
						S-3	50/3		
						S-4	50/5		
						S-5	50/1		
-6.9	15					S-6	50/1		
				Gray to Tan silty to slightly silty calcareous sand (SM) and limestone seams and shell					
						S-7	5-4-3-5		
-11.4	19.5								
				Gray, Brown and Tan Limestone		S-8	32-45-38-3		**Note:** 1. 50/2 - Indicates that the 50 blows were required to penetrate sampler 2 inches 2. Down Pressure 100 psi 3. No circulation loss was observed during drilling 4. MC - Natural Moisture Content 5. OC - Organic Content
-13.9	22								
				Gray to Tan silty to slightly silty calcareous sand (SM) and limestone seams and shell		S-10	11-11-7-8		
-16.9	25								

Peat ▨ Limestone ▨ Calcareous Sand and Limestone Seams

Sample Type ☒ SPT SAMPLE

RADISE Infrastructure Engineers • Software Developers

SHEET 1 OF 1

c:\program files\gint\projects\sta-2.gpj

DRILLING LOG

HOLE NUMBER: CP04-STA2N-CB-00022

1. PROJECT: STA-2/ Cell 4 Ehancement Project	10. SIZE AND TYPE OF BIT
2. COORDINATES: North: 746417.2 East: 796279.4	11. DATUM FOR ELEVATION SHOWN: NAVD 1988
3. DRILLING AGENCY: RADISE International	12. MANUFACTURER'S DESIGNATION OF DRILL
4. RADISE PROJECT NUMBER: 04/RB/Geot/0701 A	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 18, UNDISTURBED 0
5. NAME OF DRILLER: MP/AR	14. TOTAL NUMBER CORE BOXES: 0
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED 90 DEG. FROM HORZ.	15. STANDING WATER: +0 ft
7. THICKNESS OF OVERBURDEN: 2 ft	16. DATE HOLE: STARTED 1/8/2005, COMPLETED 1/8/2005
8. DEPTH DRILLED INTO ROCK: 48 ft	17. ELEVATION TOP OF HOLE: 8.5 ft
9. TOTAL DEPTH OF HOLE: 50 ft	18. TOTAL CORE RECOVERY FOR BORING: N/A %
	19. GEOLOGIST/ENGINEERS REPRESENTATIVE: JT

ELEV. a	DEPTH b	LEGEND c	USCS d	CLASSIFICATION OF MATERIALS (Description) e	SAMPLE TYPE f	SAMPLE NO. g	BLOWS/ 6 INCHES h	PENETRATION RESISTANCE (N) i	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) j
+8.5	0.0		PT	Dark Brown organic silt and clay with some fibrous peat		S-1	3-3-3-6		**Depth - 0' - 2'** MC - 65% OC - 12%
+6.5	2			Gray, Brown and Tan Limestone		S-2	11-13-50/1		**Drilling Time:**
						S-3	37-7-27-50/1		Feet / Min. : Sec. 0 - 1 0:10 1 - 2 0:10 2 - 3 0:15 3 - 4 0:45 4 - 5 1:10 5 - 6 1:45 6 - 7 1:38 7 - 8 0:45 8 - 9 1:48 9 - 10 1:55 10 - 11 2:28 11 - 12 1:30 12 - 13 1:28 13 - 14 0:45 14 - 15 1:43 15 - 16 0:25 16 - 17 0:35 17 - 18 0:15 18 - 19 0:15 19 - 20 0:15 20 - 21 0:30 21 - 22 0:23 22 - 23 0:32 24 - 25 0:10 25 - 26 0:25 26 - 27 0:15 27 - 28 0:10 28 - 29 0:10 29 - 30 0:10 30 - 31 0:15 31 - 32 0:10 32 - 33 0:10 33 - 34 0:15 34 - 35 0:15 35 - 36 0:20 36 - 37 0:18 37 - 38 0:15 38 - 39 0:15 39 - 40 0:15 40 - 41 0:25 41 - 42 0:35 42 - 43 0:35 43 - 44 0:30 44 - 45 0:15
						S-4	50/3		
						S-5	27-13-50/1		
						S-6	50/0		
						S-7	50/0		
-7.5	16			Gray to Tan silty to slightly silty calcareous sand (SM) and limestone seams and shell		S-8	31-48-16-4		
						S-9	8-8-11-11		
-14.5	23			Gray, Brown and Tan Limestone		S-10	22-9-20-50/3		
-16.5	25								

Peat ▨ Limestone ▨ Calcareous Sand and Limestone Seams ▨ Silty Sand

Sample Type ☒ SPT SAMPLE

RADISE Infrastructure Engineers • Software Developers

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DRILLING LOG

ELEVATION TOP OF HOLE: 8.5 ft

HOLE NUMBER: CP04-STA2N-CB-00022

PROJECT: STA-2/ Cell 4 Ehancement Project

RADISE PROJECT NUMBER: 04/RB/Geot/0701 A

INSTALLATION:

ELEV. a	DEPTH b	LEGEND c	USCS d	CLASSIFICATION OF MATERIALS (Description) e	SAMPLE TYPE f	SAMPLE NO. g	BLOWS/ 6 INCHES h	PENETRATION RESISTANCE (N) i	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) j
			SP-SM, SM	Dark Gray and Brown silty sand to sandy calcareous silt and clay with limestone fragments and shell				0 20 40 60 80 100	45 - 46 0:55 46 - 47 0:25 47 - 48 0:55 <#200 = 6%
					X	S-11	7-5-5-5		
					X	S-12	7-5-7-15		
					X	S-13	12-12-16-32		<#200 = 8%
-26.5	35							>>	
				Gray to Tan silty to slightly silty calcareous sand (SM) and limestone seams and shell	X	S-14	9-26-50/5		
					X		25-24-16-20		
								>>	
					X	S-15	50/0		
-35.5	44								
				Gray to Tan silty to slightly silty calcareous sand (SM) and limestone seams and shell	X	S-16	11-4-6-6		
-37.5	46								
				Gray, Brown and Tan Limestone				>>	
					X	S-17	32-50/1	>>	
					X	S-18	50/0		
-41.5	50								

Note:
1. 50/1 - Indicates that the 50 blows were required to penetrate sampler 1 inch
2. Down Pressure 100 psi
3. No circulation loss was observed during drilling
4. MC - Natural Moisture Content
5. OC - Organic Content
6. -200 - Percent passing U. S. Sieve 200

Peat

Limestone

Calcareous Sand and Limestone Seams

Silty Sand

Sample Type

SPT SAMPLE

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DRILLING LOG

HOLE NUMBER: CP04-STA2N-CB-00023

1. PROJECT: STA-2/ Cell 4 Ehancement Project
2. COORDINATES: North: 746024 East: 796578.5
3. DRILLING AGENCY: RADISE International
4. RADISE PROJECT NUMBER: 04/RB/Geot/0701 A
5. NAME OF DRILLER: MP/AR
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED 90 DEG. FROM HORZ.
7. THICKNESS OF OVERBURDEN: 1 ft
8. DEPTH DRILLED INTO ROCK: 49 ft
9. TOTAL DEPTH OF HOLE: 50 ft
10. SIZE AND TYPE OF BIT:
11. DATUM FOR ELEVATION SHOWN: NAVD 1988
12. MANUFACTURER'S DESIGNATION OF DRILL:
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 10 UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES: 0
15. GROUNDWATER DEPTH: 1.5 ft
16. DATE HOLE: STARTED 1/5/2005 COMPLETED 1/5/2005
17. ELEVATION TOP OF HOLE: 6.4 ft
18. TOTAL CORE RECOVERY FOR BORING: N/A %
19. GEOLOGIST/ENGINEERS REPRESENTATIVE: JT

ELEV. a	DEPTH b	LEGEND c	USCS d	CLASSIFICATION OF MATERIALS (Description) e	SAMPLE TYPE f	SAMPLE NO. g	BLOWS/ 6 INCHES h
+6.4	0.0		PT	Dark Brown organic silt and clay with some fibrous peat		S-1	4-50/2
+5.4	1			Gray, Brown and Tan Limestone		S-2	8-13-12-19
						S-3	9-50/3
						S-4	10-37-50/3
						S-5	27-37-30-50/3
						S-6	4-39-50/1
						S-7	6-5-50/3
-9.6	16			Gray to Tan silty to slightly silty calcareous sand (SM) and limestone seams and shell		S-8	11-7-6-4
						S-9	5-8-12-9
-16.6	23			Gray, Brown and Tan Limestone		S-10	11-35-24-13

PENETRATION RESISTANCE (N): 0 20 40 60 80 100

REMARKS (*Drilling time, water loss, depth weathering, etc., if significant*)

Drilling Time:

Feet	Min. : Sec.
0 - 1	2:30
1 - 2	6:50
2 - 3	2:55
3 - 4	1:48
4 - 5	2:58
5 - 6	0:45
6 - 7	1:44
7 - 8	0:58
8 - 9	1:10
9 - 10	0:48
10 - 11	0:33
11 - 12	0:28
12 - 13	0:20
13 - 14	0:25
14 - 15	1:25
15 - 16	1:25
16 - 17	0:20
17 - 18	0:18
18 - 19	0:22
19 - 20	0:15
20 - 21	0:28
21 - 22	0:35
22 - 23	0:58
24 - 25	1:18
25 - 26	0:25
26 - 27	0:18
27 - 28	0:28
28 - 29	0:15
29 - 30	0:15
30 - 31	0:23
31 - 32	0:20
32 - 33	0:25
33 - 34	0:45
34 - 35	0:48
35 - 36	0:55
36 - 37	1:00
37 - 38	1:10
38 - 39	1:10
39 - 40	1:40
40 - 41	0:58
41 - 42	0:43
42 - 43	0:45
43 - 44	0:45
44 - 45	0:58

Peat; Silty Sand; Limestone; Calcareous Sand and Limestone Seams

Sample Type ☒ SPT SAMPLE

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DRILLING LOG

ELEVATION TOP OF HOLE 6.4 ft

HOLE NUMBER: CP04-STA2N-CB-00023

PROJECT: STA-2/ Cell 4 Ehancement Project

RADISE PROJECT NUMBER: 04/RB/Geot/0701 A

INSTALLATION:

ELEV. a	DEPTH b	LEGEND c	USCS d	CLASSIFICATION OF MATERIALS (Description) e	SAMPLE TYPE f	SAMPLE NO. g	BLOWS/ 6 INCHES h	PENETRATION RESISTANCE (N) 0 20 40 i 60 80 100	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) j
-19.6	26			Gray, Brown and Tan Limestone *(continued)*					45 - 46 1:45 46 - 47 1:38 47 - 48 1:30 <#200 = 9%
			SP-SM, SM	Dark Gray and Brown silty sand to sandy calcareous silt and clay with limestone fragments and shell		S-11	7-7-7-10		
						S-12	5-15-15-25		<#200 = 19%
						S-13	12-12-17-17		
-28.6	35			Gray, Brown and Tan Limestone		S-14	34-31-17-33		
						S-15	15-14-50/4	>>	
						S-16	40-24-20-11		
						S-17	24-15-50/2	>>	
						S-18	50/2	>>	
-43.6	50					S-19	50/0	>>	

Note:
1. 50/2 - Indicates that the 50 blows were required to penetrate sampler 2 inches
2. Down Pressure 100 psi
3. No circulation loss was observed during drilling
4. NM - Natural Moisture Content
5. OC - Organic Content
6. -200 - Percent passing U. S. Sieve 200

Peat
Limestone
Calcareous Sand and Limestone Seams
Silty Sand

Sample Type SPT SAMPLE

RADISE Infrastructure Engineers • Software Developers

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DRILLING LOG

HOLE NUMBER: CP04-STA2N-CB-00024

1. PROJECT: STA-2/ Cell 4 Ehancement Project	10. SIZE AND TYPE OF BIT
2. COORDINATES: North: 753777.9 East: 801358	11. DATUM FOR ELEVATION SHOWN: NAVD 1988
3. DRILLING AGENCY: RADISE International	12. MANUFACTURER'S DESIGNATION OF DRILL
4. RADISE PROJECT NUMBER: 04/RB/Geot/0701 A	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 10, UNDISTURBED 0
5. NAME OF DRILLER: MP/AR	14. TOTAL NUMBER CORE BOXES: 0
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED 90 DEG. FROM HORZ.	15. STANDING WATER: +1 ft
7. THICKNESS OF OVERBURDEN: 1.5 ft	16. DATE HOLE: STARTED / COMPLETED
8. DEPTH DRILLED INTO ROCK: 23.5 ft	17. ELEVATION TOP OF HOLE: 7.6 ft
9. TOTAL DEPTH OF HOLE: 25 ft	18. TOTAL CORE RECOVERY FOR BORING: N/A %
	19. GEOLOGIST/ENGINEERS REPRESENTATIVE: JT

ELEV. a	DEPTH b	LEGEND c	USCS d	CLASSIFICATION OF MATERIALS (Description) e	SAMPLE TYPE f	SAMPLE NO. g	BLOWS/ 6 INCHES h	PENETRATION RESISTANCE (N) i (0 20 40 60 80 100)	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) j
+7.6	0.0		PT	Dark Brown organic silt and clay with some fibrous peat		S-1	2-2-2-50/0	>>	**Depth - 0' - 2'** MC - 103% OC - 32%
+6.1	1.5			Gray, Brown and Tan Limestone		S-2	50/0	>>	
						S-3	50/1	>>	**Drilling Time:**
						S-4	50/1	>>	**Feet / Min. : Sec.** 0 - 1 0:10 1 - 2 4:20 2 - 3 3:28 3 - 4 2:40 4 - 5 2:25 5 - 6 2:45 6 - 7 6:15 7 - 8 2:20 8 - 9 1:30 9 - 10 1:25 10 - 11 0:25 11 - 12 0:38 12 - 13 0:50 13 - 14 1:10 14 - 15 0:25 15 - 16 0:25 16 - 17 0:20 17 - 18 0:15 18 - 19 0:20 19 - 20 0:15 20 - 21 0:15 21 - 22 0:15 22 - 23 0:15
						S-5	50/3	>>	
						S-6	20-50/0	>>	
						S-7	50/5	>>	
-8.4	16			Gray to Tan silty to slightly silty calcareous sand (SM) and limestone seams and shell					
						S-8	7-10-7-12		
						S-9	3-2-12-27		**Note:** 1. 50/0 - Indicates that the 50 blows were required to penetrate sampler 0 inches 2. Down Pressure 100 psi 3. No circulation loss was observed during drilling 4. MC - Natural Moisture Content 5. OC - Organic Content
-14.4	22			Gray, Brown and Tan Limestone					
						S-10	25-20-15-10		
-17.4	25								

Peat ▨ Limestone ▨ Calcareous Sand and Limestone Seams

Sample Type ☒ SPT SAMPLE

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GRADATION CURVES

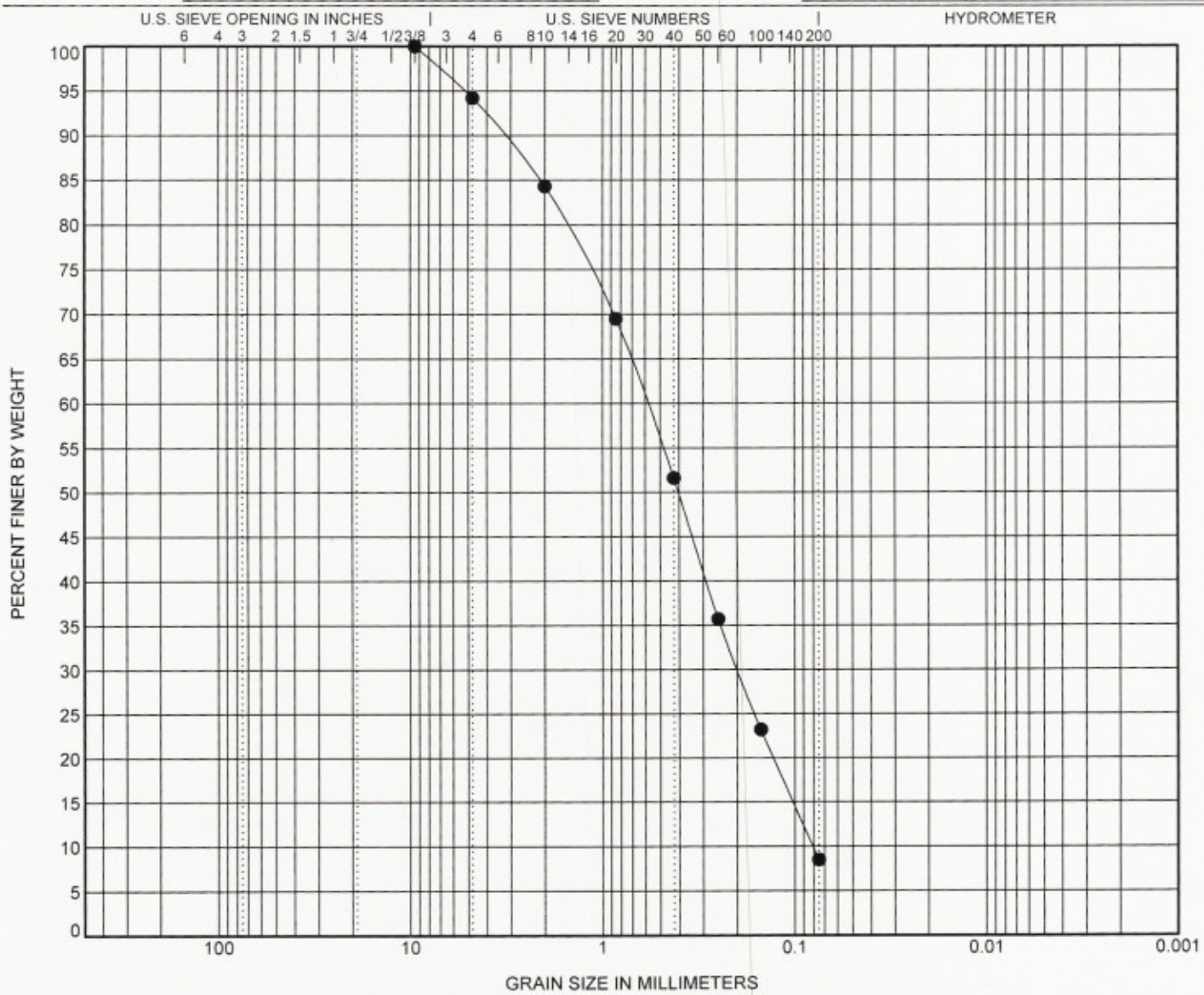
RADISE
Infrastructure Engineers • Software Developers

RADISE International
4152 West Blue Heron Boulevard, Suite 116
Riviera Beach, FL - 33404
Telephone: (561) 841 0103
Fax: (561) 841 0104

GRAIN SIZE DISTRIBUTION

CLIENT _____ **PROJECT NAME** STA-2/ Cell 4 Ehancement Project

PROJECT NUMBER 04/RB/Geot/0701 A **PROJECT LOCATION** Palm Beach County, Florida



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification		Classification	LL	PL	PI	Cc	Cu
● CB-00023	26.0					0.83	7.31

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● CB-00023	26.0	9.5	0.588	0.198	0.08	5.8	85.7	8.5	

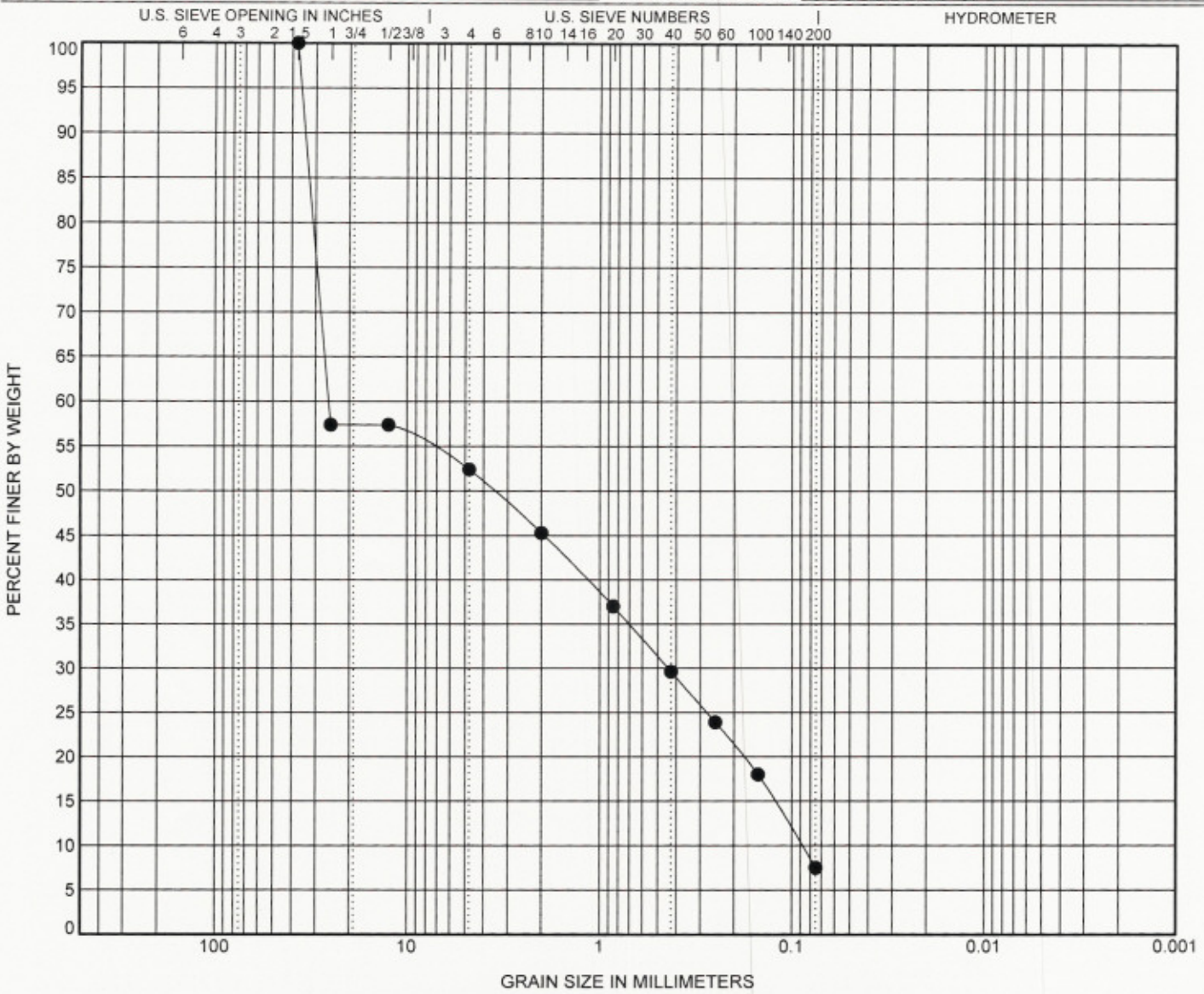
GRAIN SIZE STA-2.GPJ GINT US LAB.GDT 4/26/05

RADISE International
4152 West Blue Heron Boulevard, Suite 116
Riviera Beach, FL - 33404
Telephone: (561) 841 0103
Fax: (561) 841 0104

GRAIN SIZE DISTRIBUTION

CLIENT _____ **PROJECT NAME** STA-2/ Cell 4 Ehancement Project

PROJECT NUMBER 04/RB/Geot/0701 A **PROJECT LOCATION** Palm Beach County, Florida



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification		Classification	LL	PL	PI	Cc	Cu
● CB-00022	32.0					0.09	289.70

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● CB-00022	32.0	37.5	25.626	0.441	0.088	47.6	44.9	7.5	

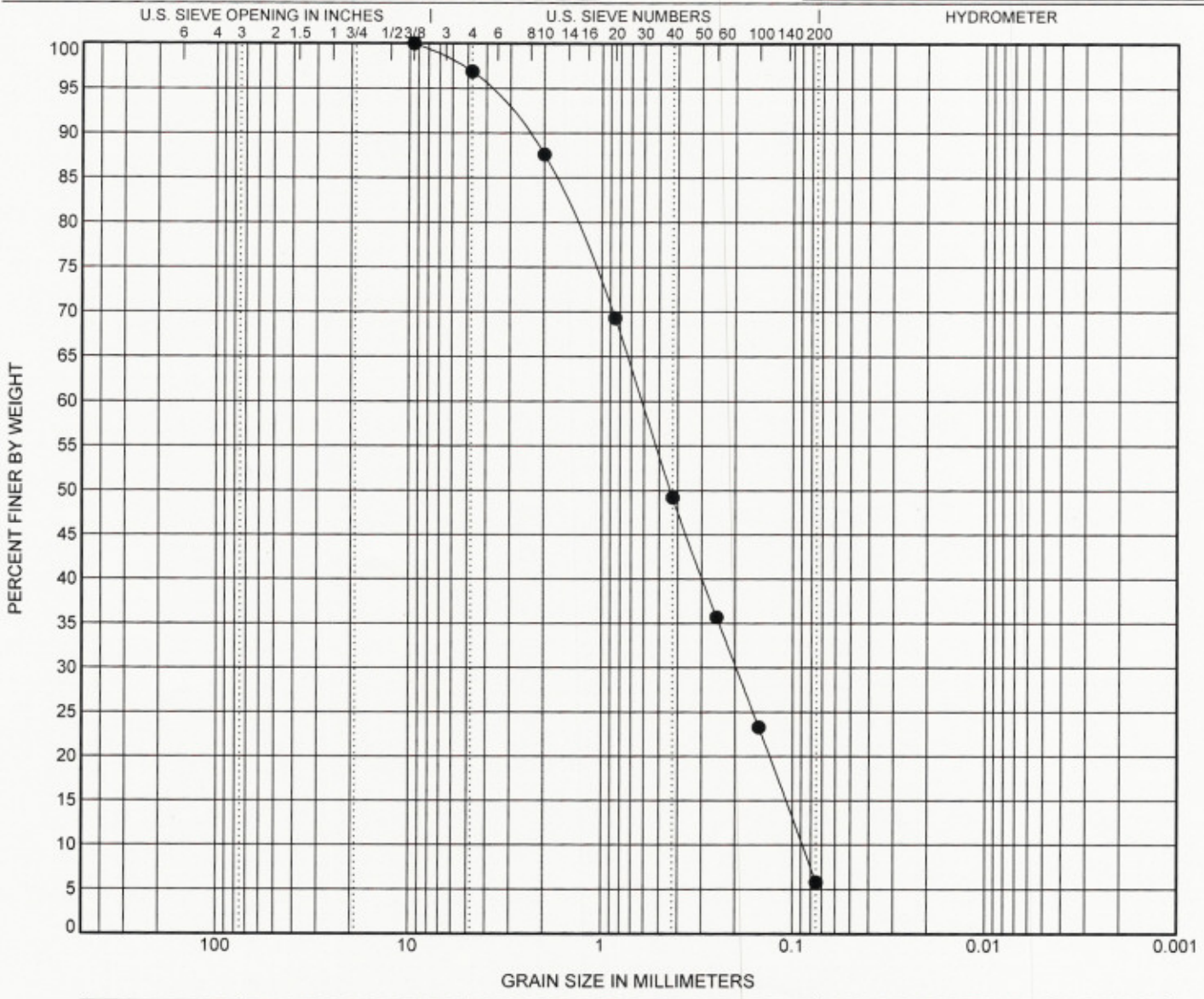
GRAIN SIZE STA-2.GPJ GINT US LAB.GDT 4/26/05

RADISE International
4152 West Blue Heron Boulevard, Suite 116
Riviera Beach, FL - 33404
Telephone: (561) 841 0103
Fax: (561) 841 0104

GRAIN SIZE DISTRIBUTION

CLIENT _____ **PROJECT NAME** STA-2/ Cell 4 Ehancement Project

PROJECT NUMBER 04/RB/Geot/0701 A **PROJECT LOCATION** Palm Beach County, Florida



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	CB-00022	26.0					0.72	6.96

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	CB-00022	26.0	9.5	0.617	0.198	0.089	3.1	91.1	5.8	

GRAIN SIZE STA-2.GPJ GINT US LAB.GDT 4/26/05

ROCK CORE BORING PROFILES

RADISE
Infrastructure Engineers • Software Developers

DRILLING LOG

HOLE NUMBER: CP04-STA2N-CB-00002

1. PROJECT: STA-2/ Cell 4 Ehancement Project	10. SIZE AND TYPE OF BIT: 4
2. COORDINATES: North: 757254.1 East: 801506.2	11. DATUM FOR ELEVATION SHOWN: NAVD 1988
3. DRILLING AGENCY: RADISE International	12. MANUFACTURER'S DESIGNATION OF DRILL: B-53 ARDCO
4. RADISE PROJECT NUMBER: 04/RB/Geot/0701 A	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN — DISTURBED: N/A; UNDISTURBED: N/A
5. NAME OF DRILLER: MP/AR	14. TOTAL NUMBER CORE BOXES: 2
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED 90 DEG. FROM HORZ.	15. STANDING WATER: +1 ft
7. THICKNESS OF OVERBURDEN: 2 ft	16. DATE HOLE — STARTED: 1/3/2005; COMPLETED: 1/3/2005
8. DEPTH DRILLED INTO ROCK: 21 ft	17. ELEVATION TOP OF HOLE: 7.5 ft
9. TOTAL DEPTH OF HOLE: 23 ft	18. TOTAL CORE RECOVERY FOR BORING: 72.5 %
	19. GEOLOGIST/ENGINEERS REPRESENTATIVE: JT

ELEV. a	DEPTH b	LEGEND c	USCS d	CLASSIFICATION OF MATERIALS (Description) e	SAMPLE TYPE f	SAMPLE NO. g	BLOWS/ 6 INCHES h	PENETRATION RESISTANCE (N) i (0 20 40 60 80 100)	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) j
+7.5	0.0		PT	Dark Brown fibrous peat with traces of organic silt and clay			2-7-14-17		**Note:** 1. Down Pressure 400 to 500 psi 2. No circulation loss was observed during drilling
+5.5	2			Gray, Brown and Tan Limestone			39-50/1		
						1			
						1			
-5.5	13			Gray to Tan silty to slightly silty calcareous sand (SM) and limestone seams and shell		2			
						2			
-15.5	23								

Peat ☐ Limestone ☐ Calcareous Sand and Limestone Seams

Sample Type ☒ SPT SAMPLE ☒ CORE SAMPLE

RADISE Infrastructure Engineers • Software Developers

SHEET 1 OF 1

c:\program files\gint\projects\sta-2.gpj

DRILLING LOG

HOLE NUMBER: CP04-STA2N-CB-00004

1. PROJECT: STA-2/ Cell 4 Ehancement Project
2. COORDINATES: North: 754265.8 East: 801535.3
3. DRILLING AGENCY: RADISE International
4. RADISE PROJECT NUMBER: 04/RB/Geot/0701 A
5. NAME OF DRILLER: MP/AR
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED 90 DEG. FROM HORZ.
7. THICKNESS OF OVERBURDEN: 2 ft
8. DEPTH DRILLED INTO ROCK: 21 ft
9. TOTAL DEPTH OF HOLE: 23 ft
10. SIZE AND TYPE OF BIT: 4
11. DATUM FOR ELEVATION SHOWN: NAVD 1988
12. MANUFACTURER'S DESIGNATION OF DRILL: B-53 ARDCO
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED N/A; UNDISTURBED N/A
14. TOTAL NUMBER CORE BOXES: 2
15. STANDING WATER: +1 ft
16. DATE HOLE: STARTED 12/31/2004; COMPLETED 12/31/2004
17. ELEVATION TOP OF HOLE: 7.2 ft
18. TOTAL CORE RECOVERY FOR BORING: 66.7 %
19. GEOLOGIST/ENGINEERS REPRESENTATIVE: JT

ELEV. a	DEPTH b	LEGEND c	USCS d	CLASSIFICATION OF MATERIALS (Description) e	SAMPLE TYPE f	SAMPLE NO. g	BLOWS/ 6 INCHES h	PENETRATION RESISTANCE (N) i	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) j
+7.2	0.0		PT	Dark Brown organic silt and clay with some fibrous peat			1-1-3-4		**Note:** 1. Down Pressure 400 to 500 psi 2. No circulation loss was observed during drilling
+5.2	2			Gray, Brown and Tan Limestone			17-12		
						1			
						1			
-6.8	14			Gray to Tan silty to slightly silty calcareous sand (SM) and limestone seams and shell		2			
-10.8	18			Gray, Brown and Tan Limestone		2			
-13.8	21			Gray to Tan silty to slightly silty calcareous sand (SM) and limestone seams and shell					
-14.8	22								

PENETRATION RESISTANCE (N) scale: 0 20 40 60 80 100

Peat; Limestone; Calcareous Sand and Limestone Seams

Sample Type: ☒ SPT SAMPLE; ◪ CORE SAMPLE

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SHEET 1 OF 1

c:\program files\gint\projects\sta-2.gpj

DRILLING LOG

HOLE NUMBER: CP04-STA2N-CB-00008

1. PROJECT: STA-2/ Cell 4 Ehancement Project	10. SIZE AND TYPE OF BIT: 4
2. COORDINATES: North: 753570.8 East: 793399.1	11. DATUM FOR ELEVATION SHOWN: NAVD 1988
3. DRILLING AGENCY: RADISE International	12. MANUFACTURER'S DESIGNATION OF DRILL: B-53 ARDCO
4. RADISE PROJECT NUMBER: 04/RB/Geot/0701 A	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN — DISTURBED: N/A; UNDISTURBED: N/A
5. NAME OF DRILLER: MP/AR	14. TOTAL NUMBER CORE BOXES: 2
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED 90 DEG. FROM HORZ.	15. STANDING WATER: +0.5 ft
7. THICKNESS OF OVERBURDEN: 3 ft	16. DATE HOLE — STARTED: 12/30/2004; COMPLETED: 12/30/2004
8. DEPTH DRILLED INTO ROCK: 20 ft	17. ELEVATION TOP OF HOLE: 7.6 ft
9. TOTAL DEPTH OF HOLE: 23 ft	18. TOTAL CORE RECOVERY FOR BORING: 49.4 %
	19. GEOLOGIST/ENGINEERS REPRESENTATIVE: JT

ELEV. a	DEPTH b	LEGEND c	USCS d	CLASSIFICATION OF MATERIALS (Description) e	SAMPLE TYPE f	SAMPLE NO. g	BLOWS/ 6 INCHES h	PENETRATION RESISTANCE (N) i (0 20 40 60 80 100)	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) j
+7.6	0.0		PT	Dark Brown fibrous peat with traces of organic silt and clay					**Note:** 1. Down Pressure 400 to 500 psi 2. No circulation loss was observed during drilling
+4.6	3			Gray, Brown and Tan Limestone		1			
						1			
-5.4	13			Gray to Tan silty to slightly silty calcareous sand (SM) and limestone seams and shell		2			
						2			
-15.4	23								

Peat ☐ Limestone ☐ Calcareous Sand and Limestone Seams

Sample Type ◪ CORE SAMPLE

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SHEET 1 OF 1

c:\program files\gint\projects\sta-2.gpj

DRILLING LOG

HOLE NUMBER: CP04-STA2N-CB-00009

1. PROJECT: STA-2/ Cell 4 Ehancement Project	10. SIZE AND TYPE OF BIT: 4
2. COORDINATES: North: 753590.3 East: 794832.9	11. DATUM FOR ELEVATION SHOWN: NAVD 1988
3. DRILLING AGENCY: RADISE International	12. MANUFACTURER'S DESIGNATION OF DRILL: B-53 ARDCO
4. RADISE PROJECT NUMBER: 04/RB/Geot/0701 A	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN — DISTURBED: N/A; UNDISTURBED: N/A
5. NAME OF DRILLER: MP/AR	14. TOTAL NUMBER CORE BOXES: 2
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED 90 DEG. FROM HORZ.	15. STANDING WATER: +0.5 ft
7. THICKNESS OF OVERBURDEN: 2 ft	16. DATE HOLE — STARTED: 12/28/2004; COMPLETED: 12/28/2004
8. DEPTH DRILLED INTO ROCK: 20 ft	17. ELEVATION TOP OF HOLE: 7.7 ft
9. TOTAL DEPTH OF HOLE: 22 ft	18. TOTAL CORE RECOVERY FOR BORING: 59.2 %
	19. GEOLOGIST/ENGINEERS REPRESENTATIVE: JT

ELEV. a	DEPTH b	LEGEND c	USCS d	CLASSIFICATION OF MATERIALS (Description) e	SAMPLE TYPE f	SAMPLE NO. g	BLOWS/ 6 INCHES h	PENETRATION RESISTANCE (N) 0 20 40 i 60 80 100	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) j
+7.7	0.0		PT	Dark Brown fibrous peat with traces of organic silt and clay			2-2-2-2		**Note:** 1. Down Pressure 400 to 500 psi 2. No circulation loss was observed during drilling
+5.7	2			Gray, Brown and Tan Limestone		1			
						1			
-4.3	12			Gray to Tan silty to slightly silty calcareous sand (SM) and limestone seams and shell		2			
-10.3	18			Gray, Brown and Tan Limestone		2			
-12.3	20			Gray to Tan silty to slightly silty calcareous sand (SM) and limestone seams and shell					
-14.3	22								

Peat ▨ Limestone ▨ Calcareous Sand and Limestone Seams

Sample Type: ☒ SPT SAMPLE; ◪ CORE SAMPLE

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SHEET 1 OF 1

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DRILLING LOG

HOLE NUMBER: CP04-STA2N-CB-00012

1. PROJECT: STA-2/ Cell 4 Ehancement Project	10. SIZE AND TYPE OF BIT: 4
2. COORDINATES: North: 753526.6 East: 799275.4	11. DATUM FOR ELEVATION SHOWN: NAVD 1988
3. DRILLING AGENCY: RADISE International	12. MANUFACTURER'S DESIGNATION OF DRILL: B-53 ARDCO
4. RADISE PROJECT NUMBER: 04/RB/Geot/0701 A	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN — DISTURBED: N/A; UNDISTURBED: N/A
5. NAME OF DRILLER: MP/AR	14. TOTAL NUMBER CORE BOXES: 2
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED 90 DEG. FROM HORZ.	15. STANDING WATER: +0 ft
7. THICKNESS OF OVERBURDEN: 3 ft	16. DATE HOLE — STARTED: 12/22/2004; COMPLETED: 12/22/2004
8. DEPTH DRILLED INTO ROCK: 20 ft	17. ELEVATION TOP OF HOLE: 7.6 ft
9. TOTAL DEPTH OF HOLE: 23 ft	18. TOTAL CORE RECOVERY FOR BORING: 73.3 %
	19. GEOLOGIST/ENGINEERS REPRESENTATIVE: JT

ELEV. a	DEPTH b	LEGEND c	USCS d	CLASSIFICATION OF MATERIALS (Description) e	SAMPLE TYPE f	SAMPLE NO. g	BLOWS/ 6 INCHES h	PENETRATION RESISTANCE (N) i (0 20 40 60 80 100)	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) j
+7.6	0.0		PT	Dark Brown fibrous peat with traces of organic silt and clay					**Note:** 1. Down Pressure 400 to 500 psi 2. No circulation loss was observed during drilling
+4.6	3			Gray, Brown and Tan Limestone		1			
						1			
-8.4	16					2			
				Gray to Tan silty to slightly silty calcareous sand (SM) and limestone seams and shell					
-12.4	20					2			
-13.4	21			Gray, Brown and Tan Limestone					
-14.4	22			Gray to Tan silty to slightly silty calcareous sand (SM) and limestone seams and shell					

Peat ▨ Limestone ▨ Calcareous Sand and Limestone Seams

Sample Type ◪ CORE SAMPLE

RADISE Infrastructure Engineers • Software Developers

SHEET 1 OF 1

c:\program files\gint\projects\sta-2.gpj

DRILLING LOG

HOLE NUMBER: CP04-STA2N-CB-00013

1. PROJECT: STA-2/ Cell 4 Ehancement Project	10. SIZE AND TYPE OF BIT: 4
2. COORDINATES: North: 743303.1 East: 797142.4	11. DATUM FOR ELEVATION SHOWN: NAVD 1988
3. DRILLING AGENCY: RADISE International	12. MANUFACTURER'S DESIGNATION OF DRILL: B-53 ARDCO
4. RADISE PROJECT NUMBER: 04/RB/Geot/0701 A	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED N/A; UNDISTURBED N/A
5. NAME OF DRILLER: MP/AR	14. TOTAL NUMBER CORE BOXES: 2
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED 90 DEG. FROM HORZ.	15. STANDING WATER: +2 ft
7. THICKNESS OF OVERBURDEN: 3 ft	16. DATE HOLE: STARTED 12/20/2004; COMPLETED 12/20/2004
8. DEPTH DRILLED INTO ROCK: 20 ft	17. ELEVATION TOP OF HOLE: 9 ft
9. TOTAL DEPTH OF HOLE: 23 ft	18. TOTAL CORE RECOVERY FOR BORING: 58.8 %
	19. GEOLOGIST/ENGINEERS REPRESENTATIVE: JT

ELEV. a	DEPTH b	LEGEND c	USCS d	CLASSIFICATION OF MATERIALS (Description) e	SAMPLE TYPE f	SAMPLE NO. g	BLOWS/ 6 INCHES h	PENETRATION RESISTANCE (N) 0 20 40 i 60 80 100	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) j
+9.0	0.0		PT	Dark Brown organic silt and clay with some fibrous peat					**Note:** 1. Down Pressure 400 to 500 psi 2. No circulation loss was observed during drilling
+6.0	3			Gray, Brown and Tan Limestone		1			
						1			
-5.0	14			Gray to Tan silty to slightly silty calcareous sand (SM) and limestone seams and shell		2			
-10.0	19			Gray, Brown and Tan Limestone		2			
-13.0	22								
-14.0	23			Gray to Tan silty to slightly silty calcareous sand (SM) and limestone seams and shell					

Peat ▨ Limestone ▨ Calcareous Sand and Limestone Seams

Sample Type ◪ CORE SAMPLE

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SHEET 1 OF 1

c:\program files\gint\projects\sta-2.gpj

DRILLING LOG

HOLE NUMBER: CP04-STA2N-CB-00015

1. PROJECT: STA-2/ Cell 4 Ehancement Project	10. SIZE AND TYPE OF BIT: 4
2. COORDINATES: North: 743319.2 East: 803137	11. DATUM FOR ELEVATION SHOWN: NAVD 1988
3. DRILLING AGENCY: RADISE International	12. MANUFACTURER'S DESIGNATION OF DRILL: B-53 ARDCO
4. RADISE PROJECT NUMBER: 04/RB/Geot/0701 A	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED N/A; UNDISTURBED N/A
5. NAME OF DRILLER: MP/AR	14. TOTAL NUMBER CORE BOXES: 2
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED 90 DEG. FROM HORZ.	15. STANDING WATER: +0.5 ft
7. THICKNESS OF OVERBURDEN: 3 ft	16. DATE HOLE: STARTED 12/21/2004; COMPLETED 12/21/2004
8. DEPTH DRILLED INTO ROCK: 20 ft	17. ELEVATION TOP OF HOLE: 8.5 ft
9. TOTAL DEPTH OF HOLE: 23 ft	18. TOTAL CORE RECOVERY FOR BORING: 58.8 %
	19. GEOLOGIST/ENGINEERS REPRESENTATIVE: JT

ELEV. a	DEPTH b	LEGEND c	USCS d	CLASSIFICATION OF MATERIALS (Description) e	SAMPLE TYPE f	SAMPLE NO. g	BLOWS/ 6 INCHES h	PENETRATION RESISTANCE (N) i (0 20 40 60 80 100)	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) j
+8.5	0.0		PT	Dark Brown fibrous peat with traces of organic silt and clay					**Note:** 1. Down Pressure 400 to 500 psi 2. No circulation loss was observed during drilling
+5.5	3			Gray, Brown and Tan Limestone		1			
						1			
-4.5	13			Gray to Tan silty to slightly silty calcareous sand (SM) and limestone seams and shell		2			
-11.5	20			Gray, Brown and Tan Limestone		2			
-14.5	23								

Peat ▭ Limestone ▭ Calcareous Sand and Limestone Seams

Sample Type ◢ CORE SAMPLE

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SHEET 1 OF 1

c:\program files\gint\projects\sta-2.gpj

DRILLING LOG

HOLE NUMBER: CP04-STA2N-CB-00017

1. PROJECT: STA-2/ Cell 4 Ehancement Project	10. SIZE AND TYPE OF BIT: 4
2. COORDINATES: North: 743318.6 East: 799761.4	11. DATUM FOR ELEVATION SHOWN: NAVD 1988
3. DRILLING AGENCY: RADISE International	12. MANUFACTURER'S DESIGNATION OF DRILL: B-53 ARDCO
4. RADISE PROJECT NUMBER: 04/RB/Geot/0701 A	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED N/A; UNDISTURBED N/A
5. NAME OF DRILLER: MP/AR	14. TOTAL NUMBER CORE BOXES: 2
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED 90 DEG. FROM HORZ.	15. GROUNDWATER DEPTH: 0.5 ft
7. THICKNESS OF OVERBURDEN: 3 ft	16. DATE HOLE: STARTED 12/22/2004; COMPLETED 12/22/2004
8. DEPTH DRILLED INTO ROCK: 20 ft	17. ELEVATION TOP OF HOLE: 8.3 ft
9. TOTAL DEPTH OF HOLE: 23 ft	18. TOTAL CORE RECOVERY FOR BORING: 72.1 %
	19. GEOLOGIST/ENGINEERS REPRESENTATIVE: JT

ELEV. a	DEPTH b	LEGEND c	USCS d	CLASSIFICATION OF MATERIALS (Description) e	SAMPLE TYPE f	SAMPLE NO. g	BLOWS/ 6 INCHES h	PENETRATION RESISTANCE (N) i (0 20 40 60 80 100)	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) j
+8.3	0.0		PT	Dark Brown fibrous peat with traces of organic silt and clay					**Note:** 1. Down Pressure 400 to 500 psi 2. No circulation loss was observed during drilling
+5.3	3			Gray, Brown and Tan Limestone		1			
-1.7	10			Gray to Tan silty to slightly silty calcareous sand (SM) and limestone seams and shell		1			
-6.7	15			Gray, Brown and Tan Limestone		2			
-7.7	16			Gray to Tan silty to slightly silty calcareous sand (SM) and limestone seams and shell		2			
-10.7	19			Gray, Brown and Tan Limestone		2			
-13.7	22			Gray to Tan silty to slightly silty calcareous sand (SM) and limestone seams and shell		2			
-14.7	23								

Peat ▭ Limestone ▭ Calcareous Sand and Limestone Seams

Sample Type ◢ CORE SAMPLE

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SHEET 1 OF 1

c:\program files\gint\projects\sta-2.gpj

DRILLING LOG

HOLE NUMBER: CP04-STA2N-CB-00019

1. PROJECT: STA-2/ Cell 4 Ehancement Project	10. SIZE AND TYPE OF BIT:
2. COORDINATES: North: 743311 East: 798052.1	11. DATUM FOR ELEVATION SHOWN: NAVD 1988
3. DRILLING AGENCY: RADISE International	12. MANUFACTURER'S DESIGNATION OF DRILL:
4. RADISE PROJECT NUMBER: 04/RB/Geot/0701 A	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN — DISTURBED: N/A; UNDISTURBED: N/A
5. NAME OF DRILLER: MP/AR	14. TOTAL NUMBER CORE BOXES: 2
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED 90 DEG. FROM HORZ.	15. STANDING WATER: +1 ft
7. THICKNESS OF OVERBURDEN: 2 ft	16. DATE HOLE — STARTED: 12/17/2004; COMPLETED: 12/17/2004
8. DEPTH DRILLED INTO ROCK: 20 ft	17. ELEVATION TOP OF HOLE: 8.5 ft
9. TOTAL DEPTH OF HOLE: 22 ft	18. TOTAL CORE RECOVERY FOR BORING: 59.6 %
	19. GEOLOGIST/ENGINEERS REPRESENTATIVE: JT

ELEV. a	DEPTH b	LEGEND c	USCS d	CLASSIFICATION OF MATERIALS (Description) e	SAMPLE TYPE f	SAMPLE NO. g	BLOWS/ 6 INCHES h	PENETRATION RESISTANCE (N) i (0 20 40 60 80 100)	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) j
+8.5	0.0		PT	Dark Brown fibrous peat with traces of organic silt and clay					**Note:** 1. Down Pressure 400 to 500 psi 2. No circulation loss was observed during drilling
+6.5	2			Gray, Brown and Tan Limestone		1			
						1			
						2			
-7.5	16			Gray to Tan silty to slightly silty calcareous sand (SM) and limestone seams and shell					
-10.5	19			Gray, Brown and Tan Limestone		2			
-11.5	20			Gray to Tan silty to slightly silty calcareous sand (SM) and limestone seams and shell					
-12.5	21			Gray, Brown and Tan Limestone					
-13.5	22								

Peat ▨ Limestone ▨ Calcareous Sand and Limestone Seams

Sample Type ◢ CORE SAMPLE

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SHEET 1 OF 1

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DRILLING LOG

HOLE NUMBER: CP04-STA2N-CB-00021

1. PROJECT: STA-2/ Cell 4 Ehancement Project	10. SIZE AND TYPE OF BIT:
2. COORDINATES: North: 743333.7 East: 804766.5	11. DATUM FOR ELEVATION SHOWN: NAVD 1988
3. DRILLING AGENCY: RADISE International	12. MANUFACTURER'S DESIGNATION OF DRILL:
4. RADISE PROJECT NUMBER: 04/RB/Geot/0701 A	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN — DISTURBED: N/A; UNDISTURBED: N/A
5. NAME OF DRILLER: MP/AR	14. TOTAL NUMBER CORE BOXES: 2
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED 90 DEG. FROM HORZ.	15. STANDING WATER: +1 ft
7. THICKNESS OF OVERBURDEN: 2 ft	16. DATE HOLE — STARTED: 12/16/2004; COMPLETED: 12/16/2004
8. DEPTH DRILLED INTO ROCK: 20 ft	17. ELEVATION TOP OF HOLE: 7.5 ft
9. TOTAL DEPTH OF HOLE: 22 ft	18. TOTAL CORE RECOVERY FOR BORING: 62.5 %
	19. GEOLOGIST/ENGINEERS REPRESENTATIVE: JT

ELEV. a	DEPTH b	LEGEND c	USCS d	CLASSIFICATION OF MATERIALS (Description) e	SAMPLE TYPE f	SAMPLE NO. g	BLOWS/ 6 INCHES h	PENETRATION RESISTANCE (N) 0 20 40 i 60 80 100	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) j
+7.5	0.0		PT	Dark Brown fibrous peat with traces of organic silt and clay					**Note:** 1. Down Pressure 400 to 500 psi 2. No circulation loss was observed during drilling
+5.5	2			Gray, Brown and Tan Limestone		1			
						1			
						2			
-7.5	15								
-9.5	17			Gray to Tan silty to slightly silty calcareous sand (SM) and limestone seams and shell					
				Gray, Brown and Tan Limestone		2			
-14.5	22								

Peat ▨ Limestone ▨ Calcareous Sand and Limestone Seams

Sample Type ◢ CORE SAMPLE

RADISE Infrastructure Engineers • Software Developers

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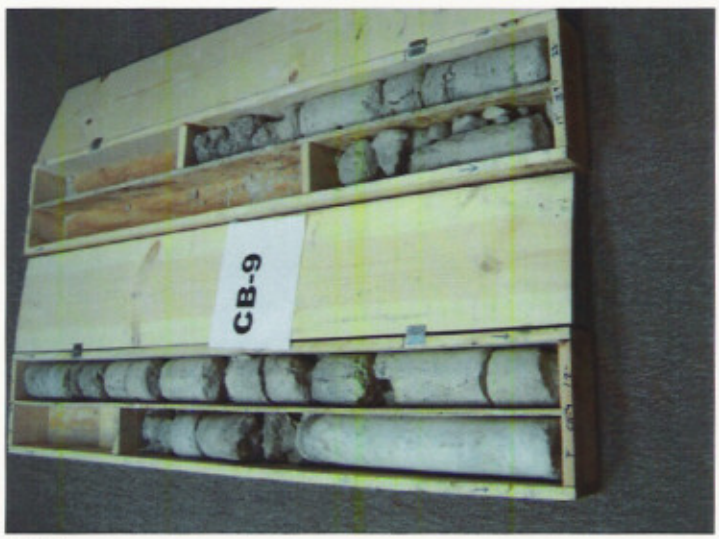
c:\program files\gint\projects\sta-2.gpj

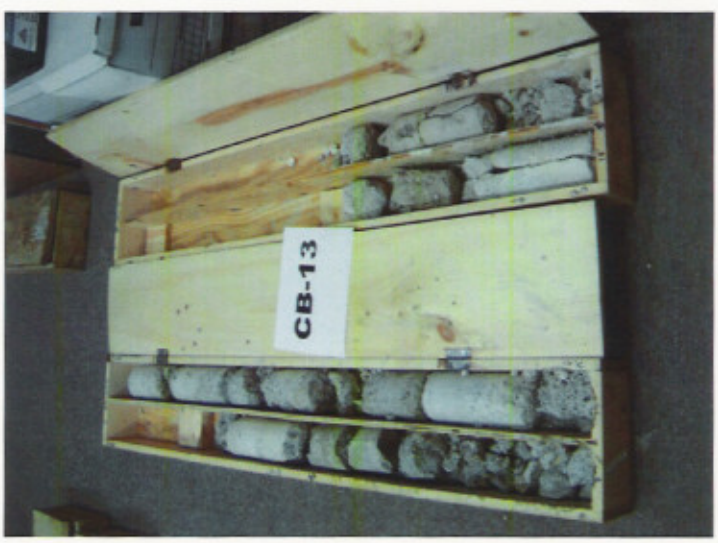
ROCK CORE PHOTOGRAPHS

RADISE
Infrastructure Engineers + Software Developers



1/3/2005
CO04-STA2N-CB00009

1/3/2005
CO04-STA2N-CB00012



1/4/2005
CO04-STA2N-CB00013

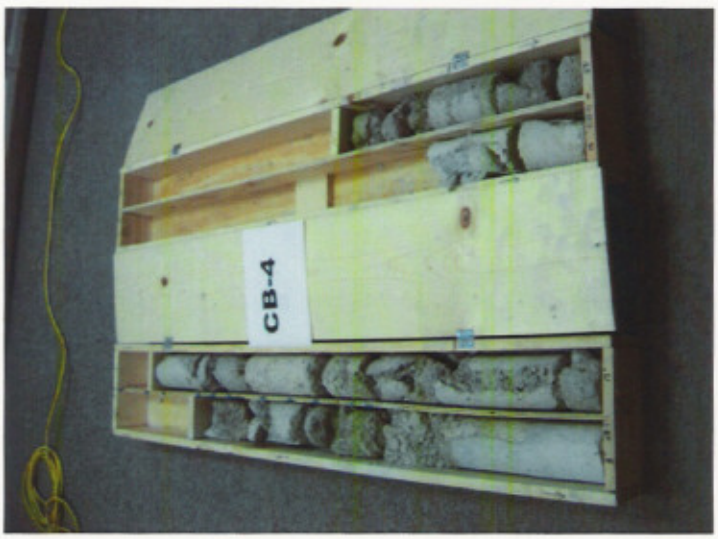
1/4/2005
CO04-STA2N-CB00008

1/4/2005
CO04-STA2N-CB00015

1/4/2005
CO04-STA2N-CB00019

1/4/2005
CO04-STA2N-CB00021

1/4/2005
CO04-STA2N-CB00017



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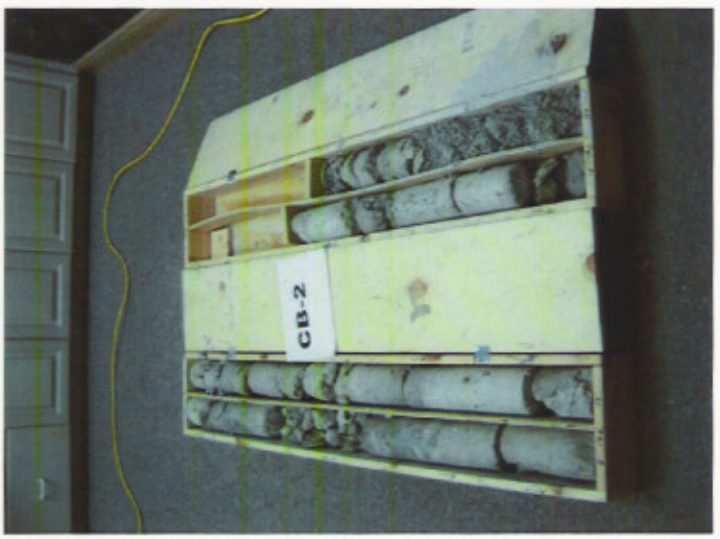
CO04-STA2N-CB00004



1/4/2005
CO04-STA2N-CB00002

APPENDIX D

TABLE D1
SUMMARY OF LABORATORY TEST RESULTS
STA 2 EXPANSION PROJECT
PALM BEACH COUNTY, FLORIDA
CONTRACT CN-040935

BORING NO.	DEPTH (ft. - ft.)	STRATUM NO.	SOIL TYPE	MC* (%)	OC** (%)	PERCENT PASSING U.S. STANDARD SIEVE SIZE										
						1-1/2"	1"	#1/2	#3/8	#4	#10	#20	#40	#60	#100	#200
CB-00003	0 - 2	1A	PT	123.2	40.5	-	-	-	-	-	-	-	-	-	-	-
CB-00005	0 - 2	1A	PT	169.7	65.0	-	-	-	-	-	-	-	-	-	-	-
CB-00014	0 - 2	1A	PT	134.9	55.0	-	-	-	-	-	-	-	-	-	-	-
CB-00016	0 - 2	1A	PT	126.0	51.5	-	-	-	-	-	-	-	-	-	-	-
CB-00018	0 - 2	1A	PT	129.9	50.2	-	-	-	-	-	-	-	-	-	-	-
CB-00020	0 - 2	1A	PT	179.7	68.4	-	-	-	-	-	-	-	-	-	-	-
CB-00024	0 - 2	1A	PT	102.5	31.7	-	-	-	-	-	-	-	-	-	-	-
CB-00001	0 - 2	1B	PT	29.5	29.1	-	-	-	-	-	-	-	-	-	-	-
CB-00006	0 - 2	1B	PT	73.4	81.6	-	-	-	-	-	-	-	-	-	-	-
CB-00011	0 - 2	1B	PT	26.9	81.8	-	-	-	-	-	-	-	-	-	-	-
CB-00022	0 - 2	1B	PT	65.4	12.1	-	-	-	-	-	-	-	-	-	-	-
CB-00022	26 - 28	3	SP-SM	4.2	-	-	-	-	100	94.2	84.3	69.5	51.6	35.7	23.2	8.5
CB-00022	29 - 31	3	SP-SM	9.9	-	-	-	-	-	-	-	-	-	-	-	7.6
CB-00022	32 - 34	3	SP-SM	12.4	-	100	57.4	57.4	57.4	52.4	45.3	37.0	29.6	23.9	8.0	7.5
CB-00023	26 - 28	3	SP-SM	12.6	-	-	-	-	100	96.9	87.6	69.3	49.2	35.7	23.3	5.8
CB-00023	29 - 31	3	SM	13.6	-	-	-	-	-	-	-	-	-	-	-	18.5

Notes: 1. Soil Type refers to the Unified Soil Classification System (ASTM D 2487)
* Moisture Content ** Organic Content

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TABLE D2
INDIVIDUAL CORES: % RECOVERY (REC) AND ROCK QUALITY DESIGNATION (RQD) DATA
STA 2 EXPANSION PROJECT
PALM BEACH COUNTY, FLORIDA
CONTRACT CN-040935

BORING NO.				% RQD							
	DEPTH	RECOVERY	RECOVERY	RECOVERED CORE SAMPLES: LENGTHS > 4 INCHES							RQD
	(ft. - ft.)	(inches)		1	2	3	4	5	6	7	
CB-00002	3 - 8	56	93.3%	4	12	15.4	8.5	-	-	-	66.5%
	8 - 13	55	91.7%	7.5	4.5	8.9	21.5	4.5	-	-	78.2%
	13 - 18	32	53.3%	8.2	14.5	-	-	-	-	-	37.8%
	18 - 23	31	51.7%	8.5	-	-	-	-	-	-	14.2%
		Total	**72.5%**							**Total**	**49.2%**
CB-00004	3 - 8	42	70.0%	4.3	4	11.8	-	-	-	-	33.5%
	8 - 13	50	83.3%	24	9	4	8.5	-	-	-	75.8%
	13 - 18	13	21.7%	5	7.2	-	-	-	-	-	20.3%
	18 - 23	55	91.7%	6.2	4.2	7	6	7	4.5	13	79.8%
		Total	**66.7%**							**Total**	**52.4%**
CB-00008	3 - 8	45	75.0%	24.5	9.5	-	-	-	-	-	56.7%
	8 - 13	41	68.3%	12.5	9.8	5.5	-	-	-	-	46.3%
	13 - 18	19.5	32.5%	4.5	4	-	-	-	-	-	14.2%
	18 - 23	13	21.7%	9	-	-	-	-	-	-	15.0%
		Total	**49.4%**							**Total**	**33.0%**
CB-00009	2 - 7	39	65.0%	8.5	20.5	-	-	-	-	-	48.3%
	7 - 12	54	90.0%	7.3	4	-	-	-	-	-	18.8%
	12 - 17	17	28.3%	10	-	-	-	-	-	-	16.7%
	17 - 22	32	53.3%	10	12.5	-	-	-	-	-	37.5%
		Total	**59.2%**							**Total**	**30.3%**
CB-00012	3 - 8	57	95.0%	11.5	4.5	15.5	8	-	-	-	65.8%
	8 - 13	41	68.3%	5	4	-	-	-	-	-	15.0%
	13 - 18	40	66.7%	7.5	8	4.2	6.5	5.5	-	-	52.8%
	18 - 23	38	63.3%	4.5	6.5	4.3	-	-	-	-	25.5%
		Total	**73.3%**							**Total**	**39.8%**
CB-00013	3 - 8	40	66.7%	10	7.5	-	-	-	-	-	29.2%
	8 - 13	52	86.7%	6	12.5	6	5.5	8.5	-	-	64.2%
	13 - 18	25	41.7%	9	5	4	-	-	-	-	30.0%
	18 - 23	24	40.0%	8.8	-	-	-	-	-	-	14.7%
		Total	**58.8%**							**Total**	**34.5%**

TABLE D2
INDIVIDUAL CORES: % RECOVERY (REC) AND ROCK QUALITY DESIGNATION (RQD) DATA
STA 2 EXPANSION PROJECT
PALM BEACH COUNTY, FLORIDA
CONTRACT CN-040935

BORING NO.				% RQD							
	DEPTH	RECOVERY	RECOVERY	RECOVERED CORE SAMPLES: LENGTHS > 4 INCHES							RQD
	(ft. - ft.)	(inches)		1	2	3	4	5	6	7	
CB-00015	3 - 8	51	85.0%	11.5	8	5	8	-	-	-	54.2%
	8 - 13	33	55.0%	5.5	5	4.5	-	-	-	-	25.0%
	13 - 18	23	38.3%	7.5	4	-	-	-	-	-	19.2%
	18 - 23	34	56.7%	5.5	9.8	-	-	-	-	-	25.5%
		Total	**58.8%**							**Total**	**31.0%**
CB-00017	3 - 8	48	80.0%	8.5	8.2	5	6	10	-	-	62.8%
	8 - 13	56	93.3%	5.5	6.5	-	-	-	-	-	20.0%
	13 - 18	44	73.3%	6	6.5	4.5	-	-	-	-	28.3%
	18 - 23	25	41.7%	4	4.3	5.5	10.2	4	-	-	46.7%
			72.1%								**39.5%**
CB-00019	2 - 7	29	48.3%	7.5	5	-	-	-	-	-	20.8%
	7 - 12	55	91.7%	4.5	6.5	5	15	4	-	-	58.3%
	12 - 17	31	51.7%	4.5	-	-	-	-	-	-	7.5%
	17 - 22	28	46.7%	8.5	6.5	8	-	-	-	-	38.3%
		Total	**59.6%**							**Total**	**31.3%**
CB-00021	2 - 7	50	83.3%	11	5.5	5	-	-	-	-	35.8%
	7 - 12	39	65.0%	12	4.5	-	-	-	-	-	27.5%
	12 - 17	36	60.0%	5.5	-	-	-	-	-	-	9.2%
	17 - 22	25	41.7%	6	4.5	-	-	-	-	-	17.5%
		Total	**62.5%**							**Total**	**22.5%**

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TABLE D3
% RECOVERY (REC) AND ROCK QUALITY DESIGNATION (RQD) DATA W.R.T DEPTH
STA 2 EXPANSION PROJECT
PALM BEACH COUNTY, FLORIDA
CONTRACT CN-040935

APPROXIMATE DEPTH (ft. - ft.)	% RECOVERY (REC) BORING NO.										BOUNDARY VALUES		
	CB-00002	CB-00004	CB-00008	CB-00009	CB-00012	CB-00013	CB-00015	CB-00017	CB-00019	CB-00021	LOWER	UPPER	MEAN
3 - 8	93.3%	70.0%	75.0%	65.0%	95.0%	66.7%	85.0%	80.0%	48.3%	83.3%	**48.3%**	**95.0%**	**76.2%**
8 - 13	91.7%	83.3%	68.3%	90.0%	68.3%	86.7%	55.0%	93.3%	91.7%	65.0%	**55.0%**	**93.3%**	**79.3%**
13 - 18	53.3%	21.7%	32.5%	28.3%	66.7%	41.7%	38.3%	73.3%	51.7%	60.0%	**21.7%**	**73.3%**	**46.8%**
18 - 23	51.7%	91.7%	21.7%	53.3%	63.3%	40.0%	56.7%	41.7%	46.7%	41.7%	**21.7%**	**91.7%**	**50.8%**
-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	**72.5%**	**66.7%**	**49.4%**	**59.2%**	**73.3%**	**58.8%**	**58.8%**	**72.1%**	**59.6%**	**62.5%**	**49.4%**	**73.3%**	**63.3%**

APPROXIMATE DEPTH (ft. - ft.)	% ROCK QUALITY DESIGNATION (RQD) BORING NO.										BOUNDARY VALUES		
	CB-00002	CB-00004	CB-00008	CB-00009	CB-00012	CB-00013	CB-00015	CB-00017	CB-00019	CB-00021	LOWER	UPPER	MEAN
3 - 8	66.5%	33.5%	56.7%	48.3%	65.8%	29.2%	54.2%	62.8%	20.8%	35.8%	**20.8%**	**66.5%**	**47.4%**
8 - 13	78.2%	75.8%	46.3%	18.8%	15.0%	64.2%	25.0%	20.0%	58.3%	27.5%	**15.0%**	**78.2%**	**42.9%**
13 - 18	37.8%	20.3%	14.2%	16.7%	52.8%	30.0%	19.2%	28.3%	7.5%	9.2%	**7.5%**	**52.8%**	**23.6%**
18 - 23	14.2%	79.8%	15.0%	37.5%	25.5%	14.7%	25.5%	46.7%	38.3%	17.5%	**14.2%**	**79.8%**	**31.5%**
-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	**49.2%**	**52.4%**	**33.0%**	**30.3%**	**39.8%**	**34.5%**	**31.0%**	**39.5%**	**31.3%**	**22.5%**	**22.5%**	**52.4%**	**36.3%**

TABLE D4
UNCONFINED COMPRESSIVE STRENGTH TEST RESULTS
STA 2 EXPANSION PROJECT
PALM BEACH COUNTY, FLORIDA
CONTRACT CN-040935

APPROXIMATE DEPTH (ft. - ft.)	UNCONFINED COMPRESSIVE STRENGTH (psi)					
	CB-00002	CB-00004	CB-00008	CB-00012	CB-00015	CB-00019
3 - 8	1,075	3,760	12,094	11,048	3,320	3,806
	1,982	2,479	1,148	710	861	-
	3,135	-	1,873	13,411	-	-
	7,318	-	-	543	-	-
8 - 13	1,670	2,157	-	-	-	1,666
	12,219	-	-	-	-	2,308
13 - 18	-	522	-	784	2,182	11,830
	-	-	-	-	-	1,322
18 - 23	-	-	-	368	-	-

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TABLE D5
SPLITTING TENSILE STRENGTH RESULTS
STA 2 EXPANSION PROJECT
PALM BEACH COUNTY, FLORIDA
CONTRACT CN-040935

APPROXIMATE DEPTH (ft. - ft.)	SPLITTING TENSILE STRENGTH (psi)					
	CB-00002	CB-00004	CB-00008	CB-00012	CB-00015	CB-00019
3 - 8	1,116	1,165	496	1,248	565	380
	1,927	1,016	463	-	727	858
	923	-	892	-	595	829
	-	-	785	-	650	-
	-	-	467	-	575	-
	-	-	885	-	-	-
	-	-	636	-	-	-
8 - 13	1,436	711	760	-	-	530
	708	-	529	-	-	416
	1,736	-	337	-	-	558
	1,751	-	370	-	-	184
13 - 18	-	-	-	102	509	1,144
	-	-	-	831	-	1,560
	-	-	-	83	-	673
	-	-	-	542	-	586
	-	-	-	353	-	580
18 - 23	-	742	-	-	-	-

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TABLE D6

ENVIRONMENTAL TEST RESULTS

Stratum 1

S. No.	Boring Number	Depth (ft.)	Corrosion Parameters			
			pH	Resistivity (ohm-cm)	Sulfate Content (mg/Kg)	Chloride Content (mg/Kg)
1	CB-00010	0 - 1	6.9	526	< 140	280

Stratum 2A

S. No.	Boring Number	Depth (ft.)	Corrosion Parameters			
			pH	Resistivity (ohm-cm)	Sulfate Content (mg/Kg)	Chloride Content (mg/Kg)
1	CB-00001	4 - 6	8.9	1587	< 59	< 12
2	CB-00003	2 - 4	8.9	1818	< 60	13
3	CB-00007	11 - 13	8.9	1042	85	19
4	CB-00011	4 - 6	8.1	769	210	23
5	CB-00014	1 - 2	8.9	1316	< 63	64
6	CB-00018	2 - 4	7.7	833	170	120
7	CB-00020	4 - 6	8.8	1612	< 62	32
8	CB-00022	2 - 4	8.5	714	130	120
9	CB-00023	23 - 25	9.3	1000	90	67
Maximum			9.3	1818	210	120
Minimum			7.7	714	< 59	< 12

Stratum 2B

S. No.	Boring Number	Depth (ft.)	Corrosion Parameters			
			pH	Resistivity (ohm-cm)	Sulfate Content (mg/Kg)	Chloride Content (mg/Kg)
1	CB-00005	14 - 16	9.0	1492	< 63	19
2	CB-00006	14 - 16	8.9	1042	160	< 13
Maximum			9.0	1492	160	19
Minimum			8.9	1042	< 63	< 13

APPENDIX E

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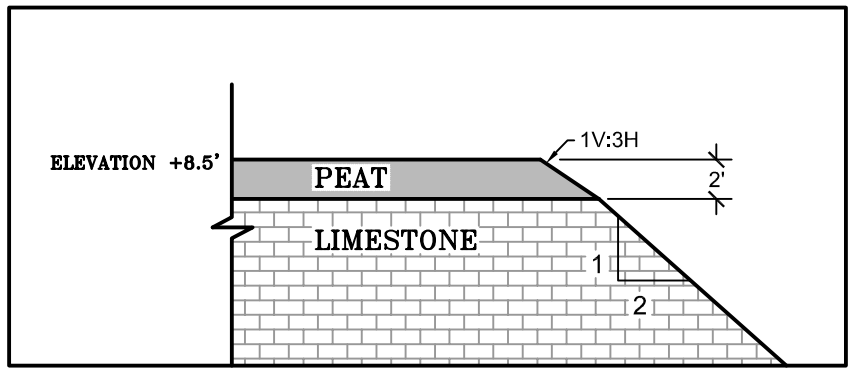

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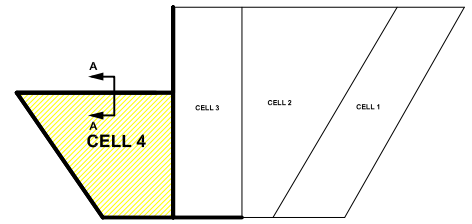
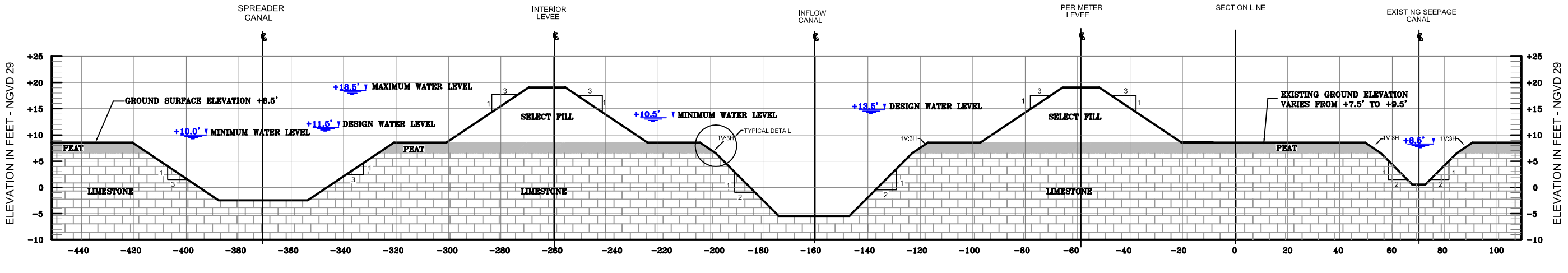


KEY MAP

NOT TO SCALE



SECTION A–A

SPREADER CANAL		
GEOMETRY		ELEVATION FEET-NGVD 29
SIDE SLOPE (H:V)	3:1	--
BOTTOM WIDTH (ft.)	34	--
DEPTH (ft.)	11	-2.5
TOP WIDTH (ft.)	100	--

INTERIOR LEVEE		
GEOMETRY		ELEVATION FEET-NGVD 29
BENCH (ft.)	20	+8.5
SIDE SLOPE (H:V)	3:1	--
TOP WIDTH (ft.)	14	--
HEIGHT (ft.)	10.5	+19.0

INFLOW CANAL		
GEOMETRY		ELEVATION FEET-NGVD 29
SIDE SLOPE (H:V)	2:1	--
BOTTOM WIDTH (ft.)	27	--
DEPTH (ft.)	14	-5.5
TOP WIDTH (ft.)	87	--

PERIMETER LEVEE		
GEOMETRY		ELEVATION FEET-NGVD 29
LEFT BENCH (ft.)	20	+8.5
SIDE SLOPE (H:V)	3:1	--
TOP WIDTH (ft.)	14	--
HEIGHT (ft.)	10.5	+19.0
RIGHT BENCH (ft.)	70	+8.5

EXISTING SEEPAGE CANAL		
GEOMETRY		ELEVATION FEET-NGVD 29
SIDE SLOPE (H:V)	2:1	--
BOTTOM WIDTH (ft.)	5	--
DEPTH (ft.)	8	+0.5
TOP WIDTH (ft.)	41	--

REVISIONS							Names	Dates
Date.	By	Descriptions	Date.	By	Descriptions	Drawn by	EA	04/25/05
						Checked by	V V	04/25/05
						Designed by		
						Checked by		
						Approved by	K A A	

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SOUTH FLORIDA WATER MANAGEMENT DISTRICT

COUNTY	CONTRACT NO
PALM BEACH	CN040935

SCALE: VERTICAL 1" = 20'

SCALE: HORIZONTAL 1" = 40'

SHEET TITLE: CROSS SECTION OF CELL 4 NORTH BOUNDARY

PROJECT NAME: STA 2/CELL 4 EXPANSION PROJECT
PALM BEACH COUNTY
FLORIDA

SHEET NO. 6 A

RADISE PROJECT NO: 04/RB/GEOT/0701

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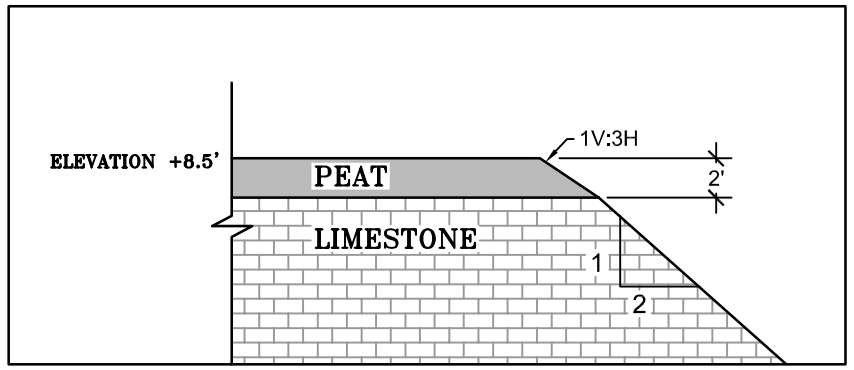

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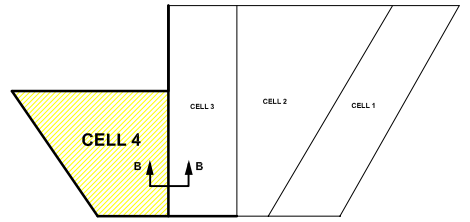
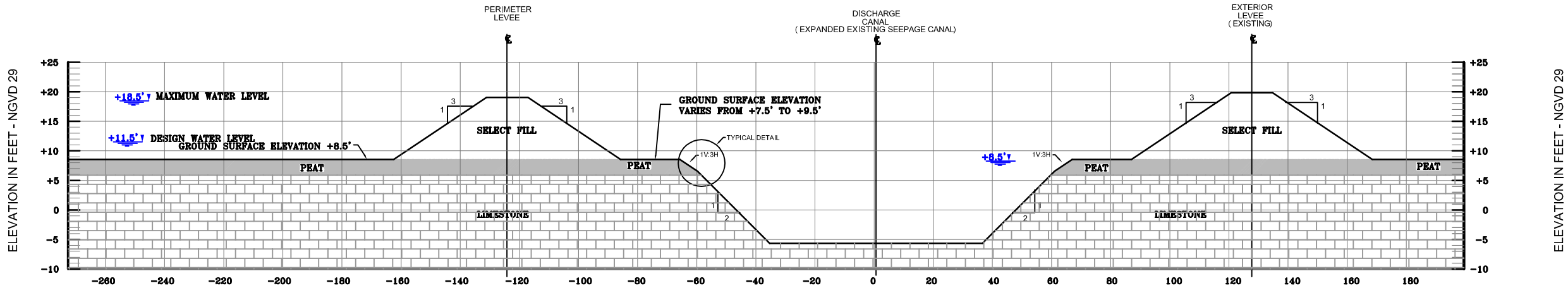


KEY MAP

NOT TO SCALE



SECTION B–B

PERIMETER LEVEE		
GEOMETRY		ELEVATION FEET-NGVD 29
BENCH (ft.)	20	+8.5
SIDE SLOPE (H:V)	3:1	--
TOP WIDTH (ft.)	14	--
HEIGHT (ft.)	10.5	+19.0

DISCHARGE CANAL		
GEOMETRY		ELEVATION FEET-NGVD 29
SIDE SLOPE (H:V)	2:1	--
BOTTOM WIDTH (ft.)	72	--
DEPTH (ft.)	14.2	-5.7
TOP WIDTH (ft.)	132.8	--

EXTERIOR LEVEE (EXISTING)		
GEOMETRY		ELEVATION FEET-NGVD 29
BENCH (ft.)	20	+8.5
SIDE SLOPE (H:V)	3:1	--
TOP WIDTH (ft.)	14	--
HEIGHT (ft.)	11.3	+19.8

REVISIONS							Names	Dates
Date.	By	Descriptions	Date.	By	Descriptions	Drawn by	EA	04/25/05
						Checked by	V V	04/25/05
						Designed by		
						Checked by		
						Approved by	K A A	

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TEL 561-841-0103 FAX 561-841-0104
URL : http:// www.radise.net

SOUTH FLORIDA WATER MANAGEMENT DISTRICT

COUNTY	CONTRACT NO
PALM BEACH	CN040935

SCALE: VERTICAL 1"=20'

SCALE: HORIZONTAL 1"=40'

SHEET TITLE: CROSS SECTION OF CELL 4 EAST BOUNDARY

PROJECT NAME: STA 2/CELL 4 EXPANSION PROJECT
PALM BEACH COUNTY
FLORIDA

SHEET NO. 6 B

RADISE PROJECT NO: 04/RB/GEOT/0701

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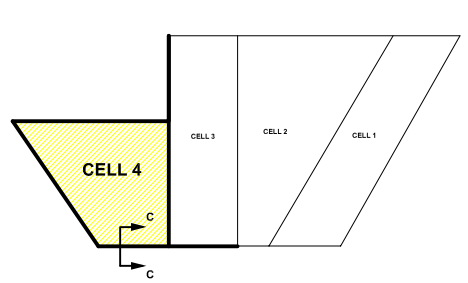
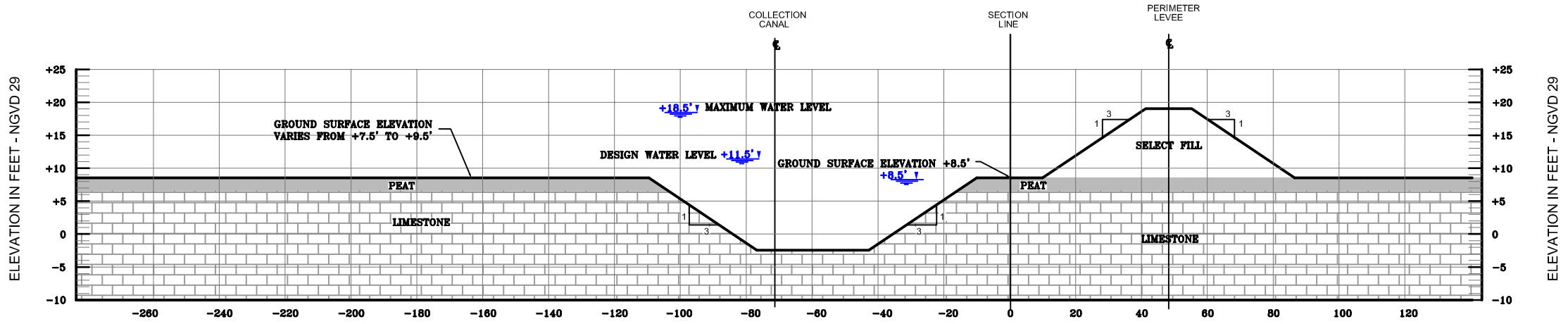


KEY MAP

NOT TO SCALE



SECTION C–C

COLLECTION CANAL		
GEOMETRY		ELEVATION FEET-NGVD 29
SIDE SLOPE (H:V)	3:1	--
BOTTOM WIDTH (ft.)	34	--
DEPTH (ft.)	11	-2.5
TOP WIDTH (ft.)	100	--

PERIMETER LEVEE		
GEOMETRY		ELEVATION FEET-NGVD 29
BENCH (ft.)	20	+8.5
SIDE SLOPE (H:V)	3:1	--
TOP WIDTH (ft.)	14	--
HEIGHT (ft.)	10.5	+19.0

REVISIONS							Names	Dates
Date.	By	Descriptions	Date.	By	Descriptions	Drawn by	EA	04/25/05
						Checked by	V V	04/25/05
						Designed by		
						Checked by		
						Approved by	K A A	

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TEL 561-841-0103 FAX 561-841-0104
URL : http:// www.radise.net

SOUTH FLORIDA WATER MANAGEMENT DISTRICT

COUNTY	CONTRACT NO
PALM BEACH	CN040935

SCALE: VERTICAL 1"=20'

SCALE: HORIZONTAL 1"=40'

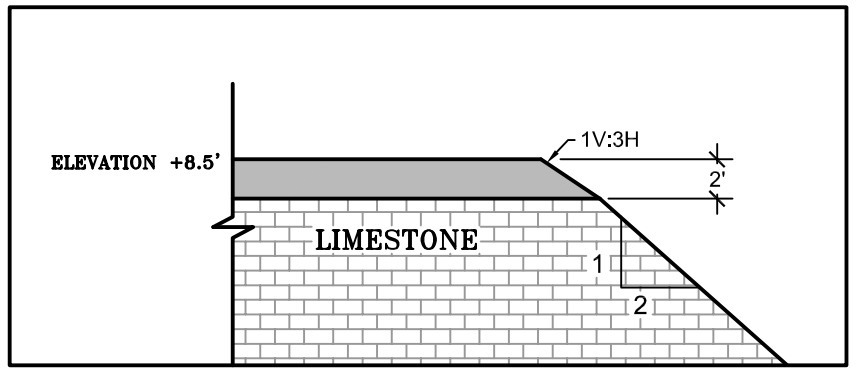
SHEET TITLE: CROSS SECTION OF CELL 4 SOUTH BOUNDARY

PROJECT NAME: STA 2/CELL 4 EXPANSION PROJECT
PALM BEACH COUNTY
FLORIDA

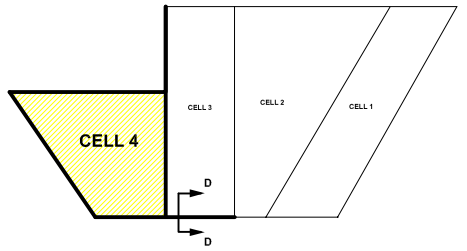
SHEET NO. 6 C

RADISE PROJECT NO: 04/RB/GEOT/0701

Z:\RADISE WORK\2004\P040701GB-BODR-REPORT\Report\BODR Submittal 04-28-2005\PDF format\Appendix E\Cross Section Cell 4 South Boundary (SHEET-6C).dwg

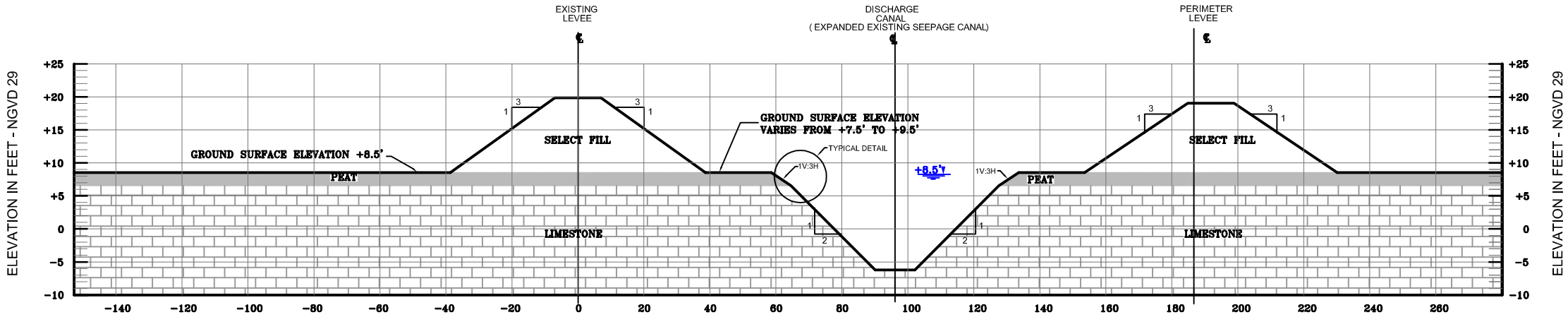


TYPICAL DETAIL



KEY MAP

NOT TO SCALE



SECTION D-D

EXISTING LEVEE		
GEOMETRY		ELEVATION FEET-NGVD 29
BENCH (ft.)	20	+8.5
SIDE SLOPE (H:V)	3:1	--
TOP WIDTH (ft.)	14	--
HEIGHT (ft.)	11.3	+19.8

DISCHARGE CANAL		
GEOMETRY		ELEVATION FEET-NGVD 29
SIDE SLOPE (H:V)	2:1	--
BOTTOM WIDTH (ft.)	12	--
DEPTH (ft.)	14.75	-6.25
TOP WIDTH (ft)	75	--

PERIMETER LEVEE		
GEOMETRY		ELEVATION FEET-NGVD 29
BENCH (ft.)	20	+8.5
SIDE SLOPE (H:V)	3:1	--
TOP WIDTH (ft.)	14	--
HEIGHT (ft.)	10.5	+19.0

REVISIONS

Date.	By	Descriptions	Date.	By	Descriptions

	Names	Dates
Drawn by	EA	04/25/05
Checked by	V V	04/25/05
Designed by		
Checked by		
Approved by	K A A	

RADISE
Infrastructure Engineers & Software Developers
LICENSE NO. - 8901

ENGINEER OF RECORD
KUMAR. A. ALLADY (P.E.No. - 52845)
RADISE International
4152 West Blue Heron Boulevard, Suite 116
Riviera Beach, Florida. 33404
TEL 561-841-0103 FAX 561-841-0104
URL : http:// www.radise.net

SOUTH FLORIDA WATER MANAGEMENT DISTRICT

COUNTY	CONTRACT NO
PALM BEACH	CN040935

SCALE: VERTICAL 1"=20'

SCALE: HORIZONTAL 1"=40'

SHEET TITLE: CROSS SECTION OF CELL 2,3 SOUTH BOUNDARY

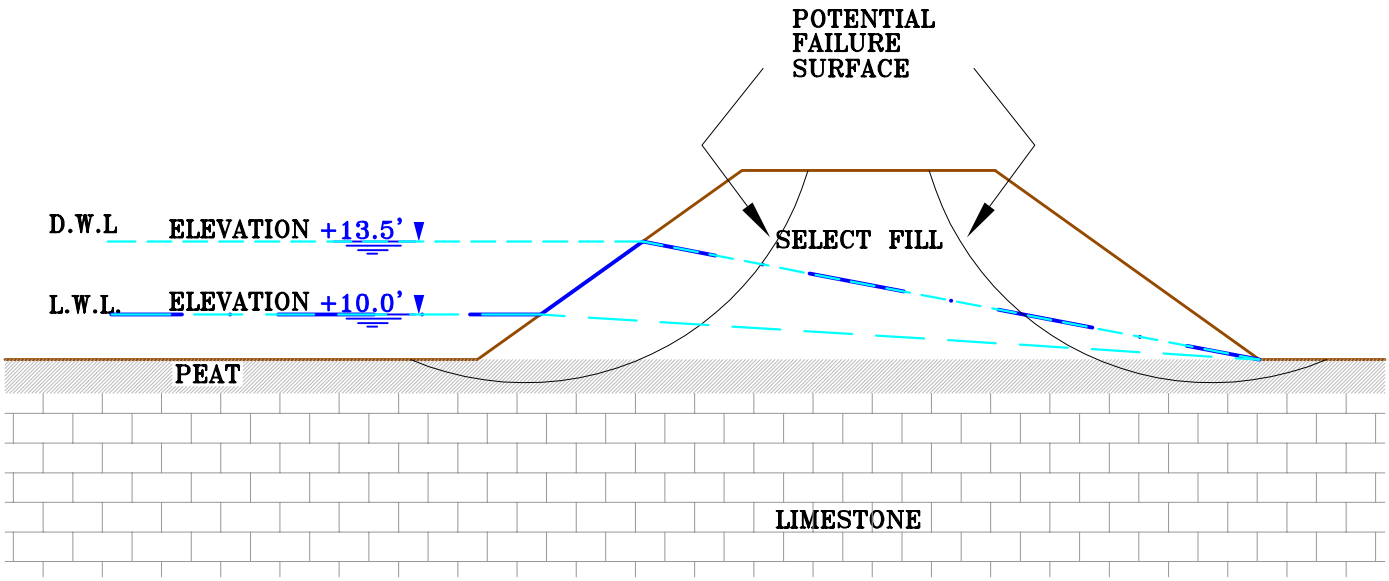
PROJECT NAME: STA 2/CELL 4 EXPANSION PROJECT
PALM BEACH COUNTY
FLORIDA

SHEET NO. 6 D

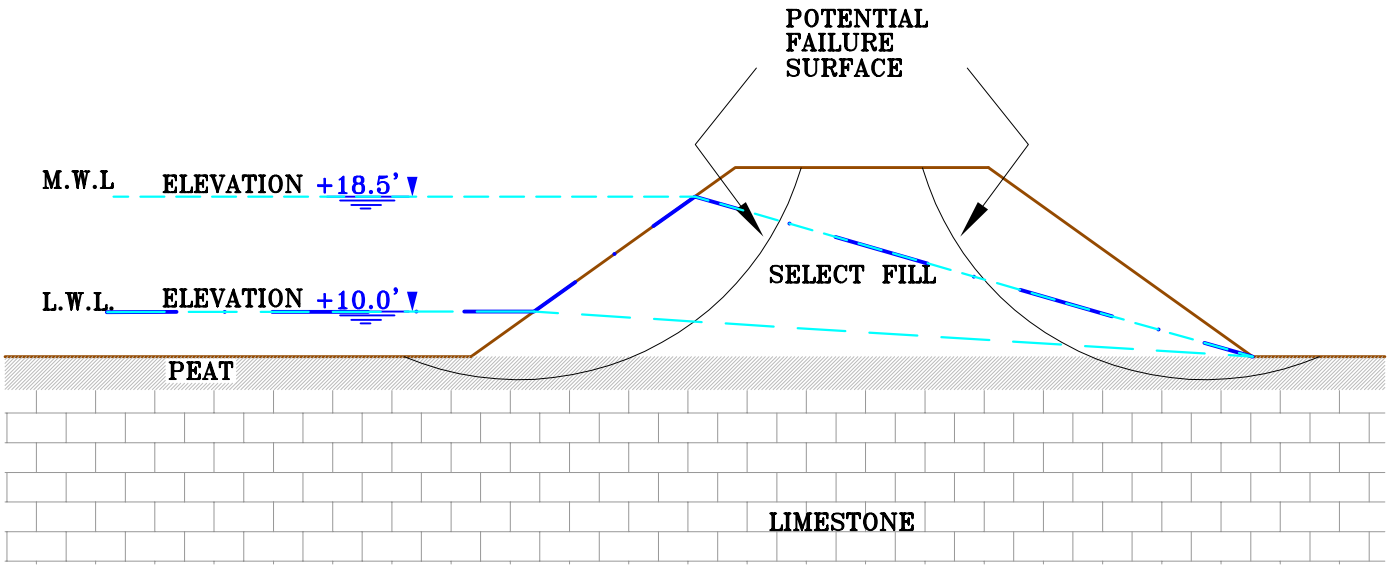
RADISE PROJECT NO: 04/RB/GEOT/0701

Z:\RADISE WORK\2004\P040701GB-BODR-REPORT\Report\BODR Submittal 04-28-2005\PDF format\Appendix E\Cross Section Cell 2,3 South Boundary (SHEET-6D).dwg

NORMAL OPERATION



WORST FLOOD CONDITION



M.W.L	MAXIMUM WATER LEVEL
D.W.L	DESIGN WATER LEVEL
L.W.L.	LOW WATER LEVEL
	FOR STEADY SEEPAGE STATE
	FOR END OF CONSTRUCTION STATE
	FOR RAPID DRAWDOWN STATE

SCHEMATIC DIAGRAM OF SLOPE STABILITY ANALYSIS
STA 2/CELL 4 EXPANSION PROJECT
PALM BEACH COUNTY, FLORIDA

PROJ. NO. 04/RB/GEOT/0701

RADISE International
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Riviera Beach, Florida 33404
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URL:http://www.radise.net
RADISE Infrastructure Engineers & Software Developers

DRAWN	CHECKED	DATE	SCALE
EA	V V	04/25/05	NOT TO SCALE
APPROVED	REVISED		SHEET
KAA	04/25/05		7

Z:\RADISE WORK\2004\P040701GB-BODR-REPORT\Report\BODR Submittal 04-28-2005\PDF format\Appendix E\Schematic of SLOPE STABILITY (SHEET-7).dwg

Table E1. Result of Stability Analysis for the Interior Levee in Cell 4 North Boundary for Maximum Water Level

		Factors of Safety			Plot File Name		
		End of Construction	Steady State Seepage	Rapid Draw Down	End of Construction	Steady State Seepage	Rapid Draw Down
Upstream	Water Level	10.0	18.5	N/A			
	Muck Depth						
	4	1.6	1.5	N/A	CS2EP4Levee.IN	CS2SP4Levee.IN	N/A
	3	1.7	1.5	N/A	CS2EP3Levee.IN	CS2SP3Levee.IN	N/A
	2	1.8	1.9	N/A	CS2EP2Levee.IN	CS2SP2Levee.IN	N/A
Downstream	Water Level	10.0	N/A	18.5/10.0			
	Muck Depth						
	4	1.6	N/A	1.2	CS2EP4Levee.IN	N/A	CS1RP4Levee.IN
	3	1.7	N/A	1.3	CS2EP3Levee.IN	N/A	CS1RP3Levee.IN
	2	1.8	N/A	1.6	CS2EP2Levee.IN	N/A	CS1RP2Levee.IN

Notes

Levee Height = 11.5
Levee Slope = 3:1
All Linear dimensions are expressed in feet

Table E2. Result of Stability Analysis for the Interior Levee in Cell 4 North Boundary for Design Water Level

		Factors of Safety			Plot File Name		
		End of Construction	Steady State Seepage	Rapid Draw Down	End of Construction	Steady State Seepage	Rapid Draw Down
Upstream	Water Level	10.0	13.5	N/A			
	Muck Depth						
	4	1.6	1.8	N/A	CS2EP4Levee.IN	CS2SP4LeveeDWL.IN	N/A
	3	1.7	1.8	N/A	CS2EP3Levee.IN	CS2SP3LeveeDWL.IN	N/A
	2	1.8	2.4	N/A	CS2EP2Levee.IN	CS2SP2LeveeDWL.IN	N/A
Downstream	Water Level	10.0	N/A	13.5/10.0			
	Muck Depth						
	4	1.6	N/A	1.5	CS2EP4Levee.IN	N/A	CS1RP4LeveeDWL.IN
	3	1.7	N/A	1.6	CS2EP3Levee.IN	N/A	CS1RP3LeveeDWL.IN
	2	1.8	N/A	2.0	CS2EP2Levee.IN	N/A	CS1RP2LeveeDWL.IN

Notes

Levee Height = 11.5
Levee Slope = 3:1
All Linear dimensions are expressed in feet

Table E3. Result of Stability Analysis for the Perimeter Levee in Cell 4 North Boundary

		Factors of Safety			Plot File Name		
		End of Construction	Steady State Seepage	Rapid Draw Down	End of Construction	Steady State Seepage	Rapid Draw Down
Upstream	Water Level	10.0	13.5	N/A			
	Muck Depth						
	4	1.6	1.8	N/A	CS2EP4Levee.IN	CS2SP4LeveeDWL.IN	N/A
	3	1.7	1.8	N/A	CS2EP3Levee.IN	CS2SP3LeveeDWL.IN	N/A
	2	1.8	2.4	N/A	CS2EP2Levee.IN	CS2SP2LeveeDWL.IN	N/A
Downstream	Water Level	10.0	13.5	13.5/10.0			
	Muck Depth						
	4	1.6	1.8	1.5	CS2EP4Levee.IN	CS2SP4LeveeDWL.IN	CS1RP4LeveeDWL.IN
	3	1.7	1.8	1.6	CS2EP3Levee.IN	CS2SP3LeveeDWL.IN	CS1RP3LeveeDWL.IN
	2	1.8	2.4	2.0	CS2EP2Levee.IN	CS2SP2LeveeDWL.IN	CS1RP2LeveeDWL.IN

Notes

Levee Height = 11.5
Levee Slope = 3:1
All Linear dimensions are expressed in feet

Table E4. Result of Stability Analysis for the Perimeter Levee in Cell 4 East Boundary for Maximum Water Level

		Factors of Safety			Plot File Name		
		End of Construction	Steady State Seepage	Rapid Draw Down	End of Construction	Steady State Seepage	Rapid Draw Down
Upstream	Water Level	10.0	18.5	N/A			
	Muck Depth						
	4	1.6	1.5	N/A	CS2EP4Levee.IN	CS2SP4Levee.IN	N/A
	3	1.7	1.5	N/A	CS2EP3Levee.IN	CS2SP3Levee.IN	N/A
	2	1.8	1.9	N/A	CS2EP2Levee.IN	CS2SP2Levee.IN	N/A
Downstream	Water Level	10.0	N/A	18.5/10.0			
	Muck Depth						
	4	1.6	N/A	1.2	CS2EP4Levee.IN	N/A	CS1RP4Levee.IN
	3	1.7	N/A	1.3	CS2EP3Levee.IN	N/A	CS1RP3Levee.IN
	2	1.8	N/A	1.6	CS2EP2Levee.IN	N/A	CS1RP2Levee.IN

Notes

Levee Height = 11.5
Levee Slope = 3:1
All Linear dimensions are expressed in feet

Table E5. Result of Stability Analysis for the Perimeter Levee in Cell 4 East Boundary for Design Water Level

		Factors of Safety			Plot File Name		
		End of Construction	Steady State Seepage	Rapid Draw Down	End of Construction	Steady State Seepage	Rapid Draw Down
Upstream	Water Level	10.0	13.5	N/A			
	Muck Depth						
	4	1.6	1.8	N/A	CS2EP4Levee.IN	CS2SP4LeveeDWL.IN	N/A
	3	1.7	1.8	N/A	CS2EP3Levee.IN	CS2SP3LeveeDWL.IN	N/A
	2	1.8	2.4	N/A	CS2EP2Levee.IN	CS2SP2LeveeDWL.IN	N/A
Downstream	Water Level	10.0	N/A	13.5/10.0			
	Muck Depth						
	4	1.6	N/A	1.5	CS2EP4Levee.IN	N/A	CS1RP4LeveeDWL.IN
	3	1.7	N/A	1.6	CS2EP3Levee.IN	N/A	CS1RP3LeveeDWL.IN
	2	1.8	N/A	2.0	CS2EP2Levee.IN	N/A	CS1RP2LeveeDWL.IN

Notes

Levee Height = 11.5
Levee Slope = 3:1
All Linear dimensions are expressed in feet

Table E6. Result of Stability Analysis for the Existing Exterior Levee in Cell 4 East Boundary

		Factors of Safety			Plot File Name		
		End of Construction	Steady State Seepage	Rapid Draw Down	End of Construction	Steady State Seepage	Rapid Draw Down
Upstream	Water Level	10.0	N/A	N/A			
	Muck Depth						
	4	1.3	N/A	N/A	CS3EP4Levee.IN	N/A	N/A
	3	1.5	N/A	N/A	CS3EP3Levee.IN	N/A	N/A
	2	1.9	N/A	N/A	CS3EP2Levee.IN	N/A	N/A
Downstream	Water Level	10.0	N/A	N/A			
	Muck Depth						
	4	1.3	N/A	N/A	CS3EP4Levee.IN	N/A	N/A
	3	1.5	N/A	N/A	CS3EP3Levee.IN	N/A	N/A
	2	1.9	N/A	N/A	CS3EP2Levee.IN	N/A	N/A

Notes

Levee Height = 12.3
Levee Slope = 3:1
All Linear dimensions are expressed in feet

Table E7. Result of Stability Analysis for the Perimeter Levee in Cell 4 South Boundary for Maximum Water Level

		Factors of Safety			Plot File Name		
		End of Construction	Steady State Seepage	Rapid Draw Down	End of Construction	Steady State Seepage	Rapid Draw Down
Upstream	Water Level	10.0	N/A	18.5/10.0			
	Muck Depth						
	4	1.6	N/A	1.2	CS2EP4Levee.IN	N/A	CS1RP4Levee.IN
	3	1.7	N/A	1.3	CS2EP3Levee.IN	N/A	CS1RP3Levee.IN
	2	1.8	N/A	1.6	CS2EP2Levee.IN	N/A	CS1RP2Levee.IN
Downstream	Water Level	10.0	18.5	N/A			
	Muck Depth						
	4	1.6	1.5	N/A	CS2EP4Levee.IN	CS2SP4Levee.IN	N/A
	3	1.7	1.5	N/A	CS2EP3Levee.IN	CS2SP3Levee.IN	N/A
	2	1.8	1.9	N/A	CS2EP2Levee.IN	CS2SP2Levee.IN	N/A

Notes

Levee Height = 11.5
Levee Slope = 3:1
All Linear dimensions are expressed in feet

Table E8. Result of Stability Analysis for the Perimeter Levee in Cell 4 South Boundary for Design Water Level

		Factors of Safety			Plot File Name		
		End of Construction	Steady State Seepage	Rapid Draw Down	End of Construction	Steady State Seepage	Rapid Draw Down
Upstream	Water Level	10.0	N/A	13.5/10.0			
	Muck Depth						
	4	1.6	N/A	1.5	CS2EP4Levee.IN	N/A	CS1RP4LeveeDWL.IN
	3	1.7	N/A	1.6	CS2EP3Levee.IN	N/A	CS1RP3LeveeDWL.IN
	2	1.8	N/A	2.0	CS2EP2Levee.IN	N/A	CS1RP2LeveeDWL.IN
Downstream	Water Level	10.0	13.5	N/A			
	Muck Depth						
	4	1.6	1.8	N/A	CS2EP4Levee.IN	CS2SP4LeveeDWL.IN	N/A
	3	1.7	1.8	N/A	CS2EP3Levee.IN	CS2SP3LeveeDWL.IN	N/A
	2	1.8	2.4	N/A	CS2EP2Levee.IN	CS2SP2LeveeDWL.IN	N/A

Notes

Levee Height = 11.5
Levee Slope = 3:1
All Linear dimensions are expressed in feet

Table E9. Result of Stability Analysis for the Existing Levee in Cells 2,3 South Boundary

		Factors of Safety			Plot File Name		
		End of Construction	Steady State Seepage	Rapid Draw Down	End of Construction	Steady State Seepage	Rapid Draw Down
Upstream	Water Level	10.0	N/A	N/A			
	Muck Depth						
	4	1.3	N/A	N/A	CS3EP4Levee.IN	N/A	N/A
	3	1.5	N/A	N/A	CS3EP3Levee.IN	N/A	N/A
	2	1.9	N/A	N/A	CS3EP2Levee.IN	N/A	N/A
Downstream	Water Level	10.0	N/A	N/A			
	Muck Depth						
	4	1.3	N/A	N/A	CS3EP4Levee.IN	N/A	N/A
	3	1.5	N/A	N/A	CS3EP3Levee.IN	N/A	N/A
	2	1.9	N/A	N/A	CS3EP2Levee.IN	N/A	N/A

Notes

Levee Height = 12.3
Levee Slope = 3:1
All Linear dimensions are expressed in feet

Table E10. Result of Stability Analysis for the Perimeter Levee in Cells 2,3 South Boundary

		Factors of Safety			Plot File Name		
		End of Construction	Steady State Seepage	Rapid Draw Down	End of Construction	Steady State Seepage	Rapid Draw Down
Upstream	Water Level	10.0	N/A	N/A			
	Muck Depth						
	4	1.6	N/A	N/A	CS2EP4Levee.IN	N/A	N/A
	3	1.7	N/A	N/A	CS2EP3Levee.IN	N/A	N/A
	2	1.8	N/A	N/A	CS2EP2Levee.IN	N/A	N/A
Downstream	Water Level	10.0	N/A	N/A			
	Muck Depth						
	4	1.6	N/A	N/A	CS2EP4Levee.IN	N/A	N/A
	3	1.7	N/A	N/A	CS2EP3Levee.IN	N/A	N/A
	2	1.8	N/A	N/A	CS2EP2Levee.IN	N/A	N/A

Notes

Levee Height = 11.5
Levee Slope = 3:1
All Linear dimensions are expressed in feet

Table E11. Result of Stability Analysis for a Typical Canal

		Factors of Safety		Plot File Name	
		Dewatered Canal	Normal Operation	Dewatered Canal	Normal Operation
Upstream	Water Level	0.0	10.0		
	Slope				
	2:1	72	127	CS2DP4Canal.IN	CS2NP4Canal.IN
	3:1	72	127	CS2DP4Canal.IN	CS2NP4Canal.IN
Downstream	Water Level	0.0	10.0		
	Slope				
	2:1	72	127	CS2DP4Canal.IN	CS2NP4Canal.IN
	3:1	72	127	CS2DP4Canal.IN	CS2NP4Canal.IN

Notes

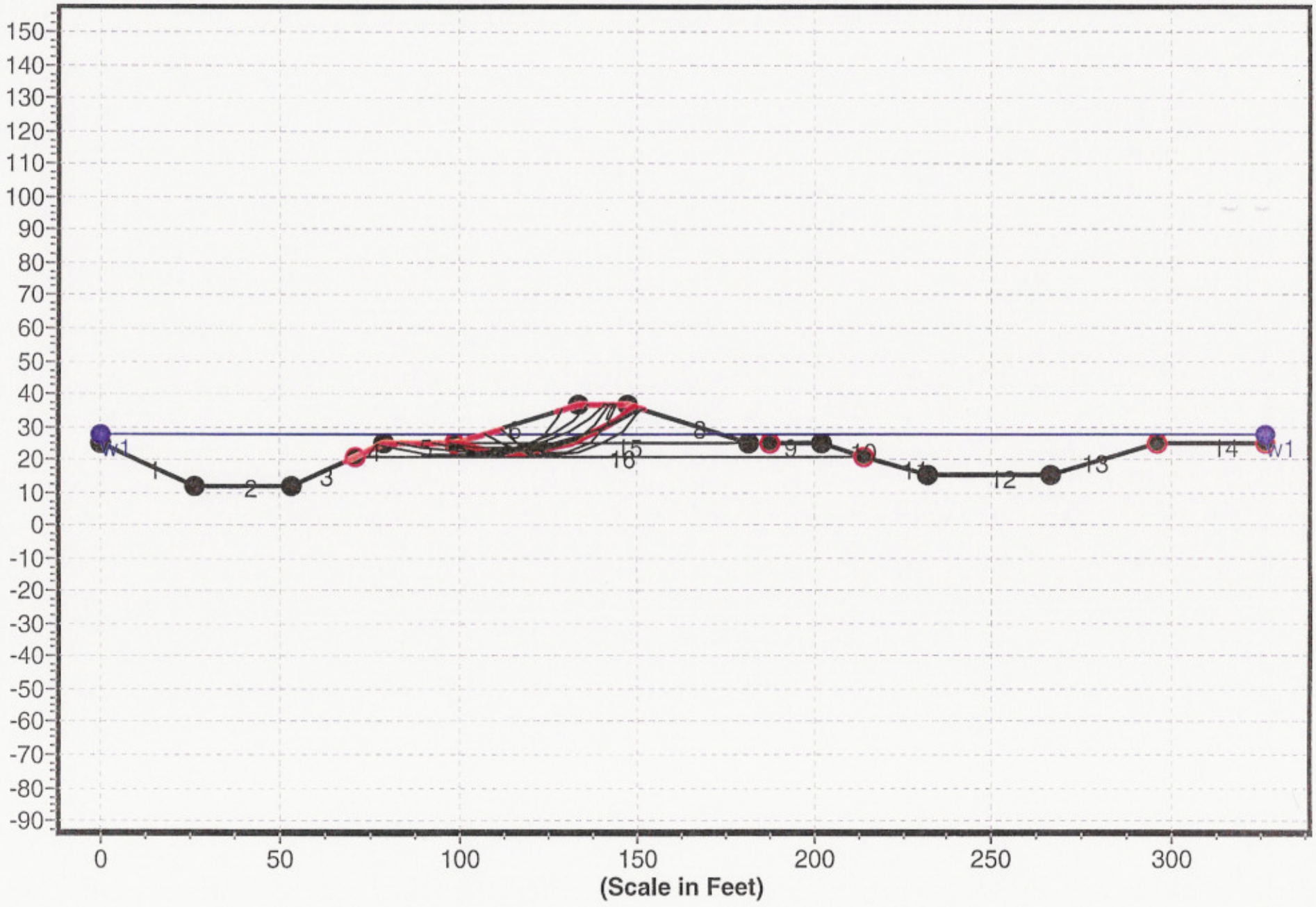
Canal Depth = 11 to 14.75
Peat thickness = 4
All Linear dimensions are expressed in feet

Table E12. Result of Stability Analysis for the Global Stability

	Factors of Safety	Plot File Name
	Normal Operation	Normal Operation
Water Level	13.5	
Upstream	43	CS2SP4Whole.IN
Downstream	43	CS2SP4Whole.IN

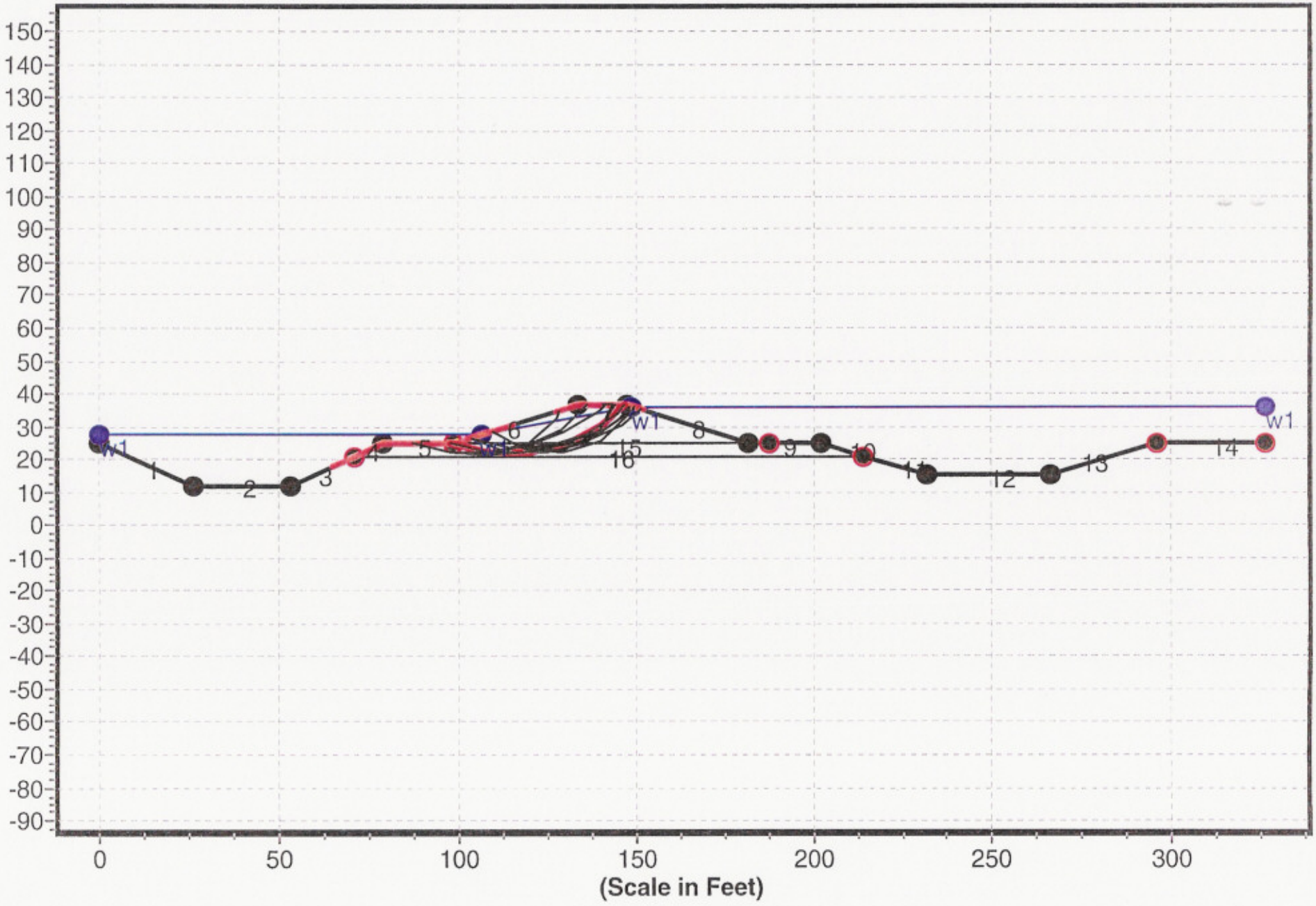
Notes

Levee Height = 8.5 to 12.3
Canal Depth = 11 to 14.75
Levee Slope = 3:1
Canal Slope = 2:1 to 3:1
Peat thickness = 4
All Linear dimensions are expressed in feet


Geometry and Boundary Conditions
Problem: U/S of Interior Levee of Cell 4 North Bdry - End of Construction - FS Min = 1.603
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
0
50
100
150
200
250
300
(Scale in Feet)
w1
w1
1
2
3
8
9
12
13
14
15
16

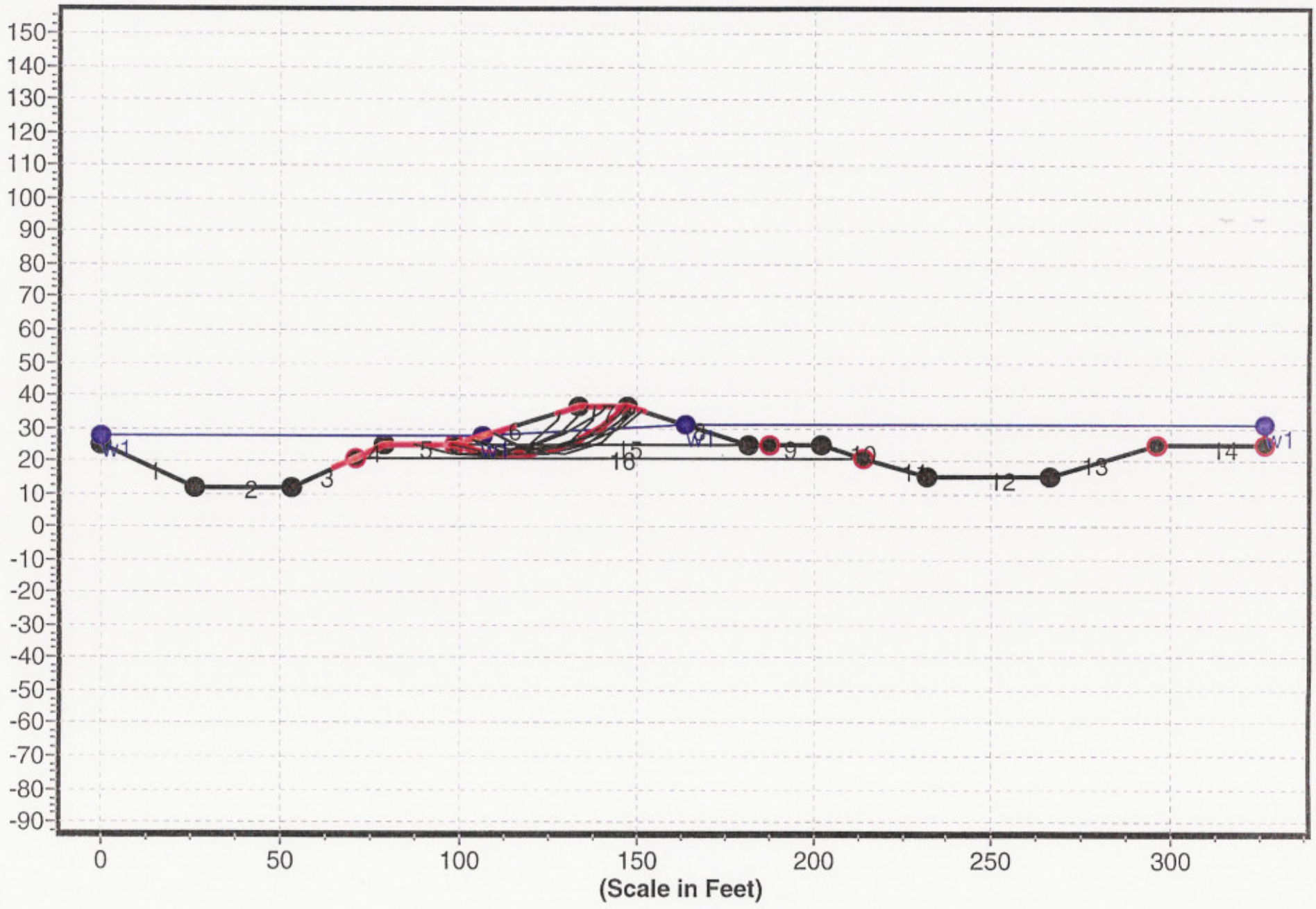
Geometry and Boundary Conditions

Problem: U/S of Inetrior Levee of Cell 4 North Bdry - MWL - Steady State - FS Min = 1.506



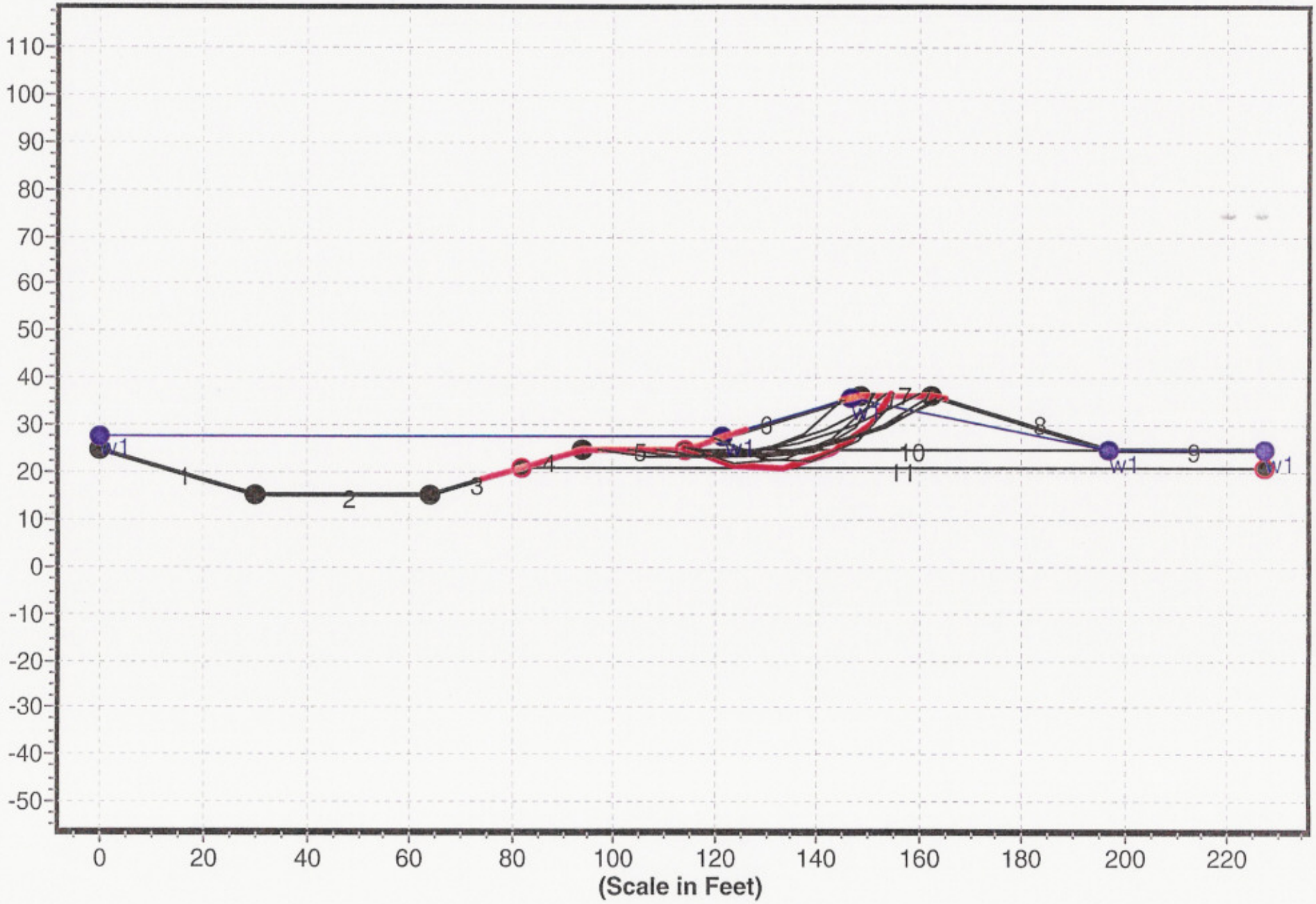
Geometry and Boundary Conditions

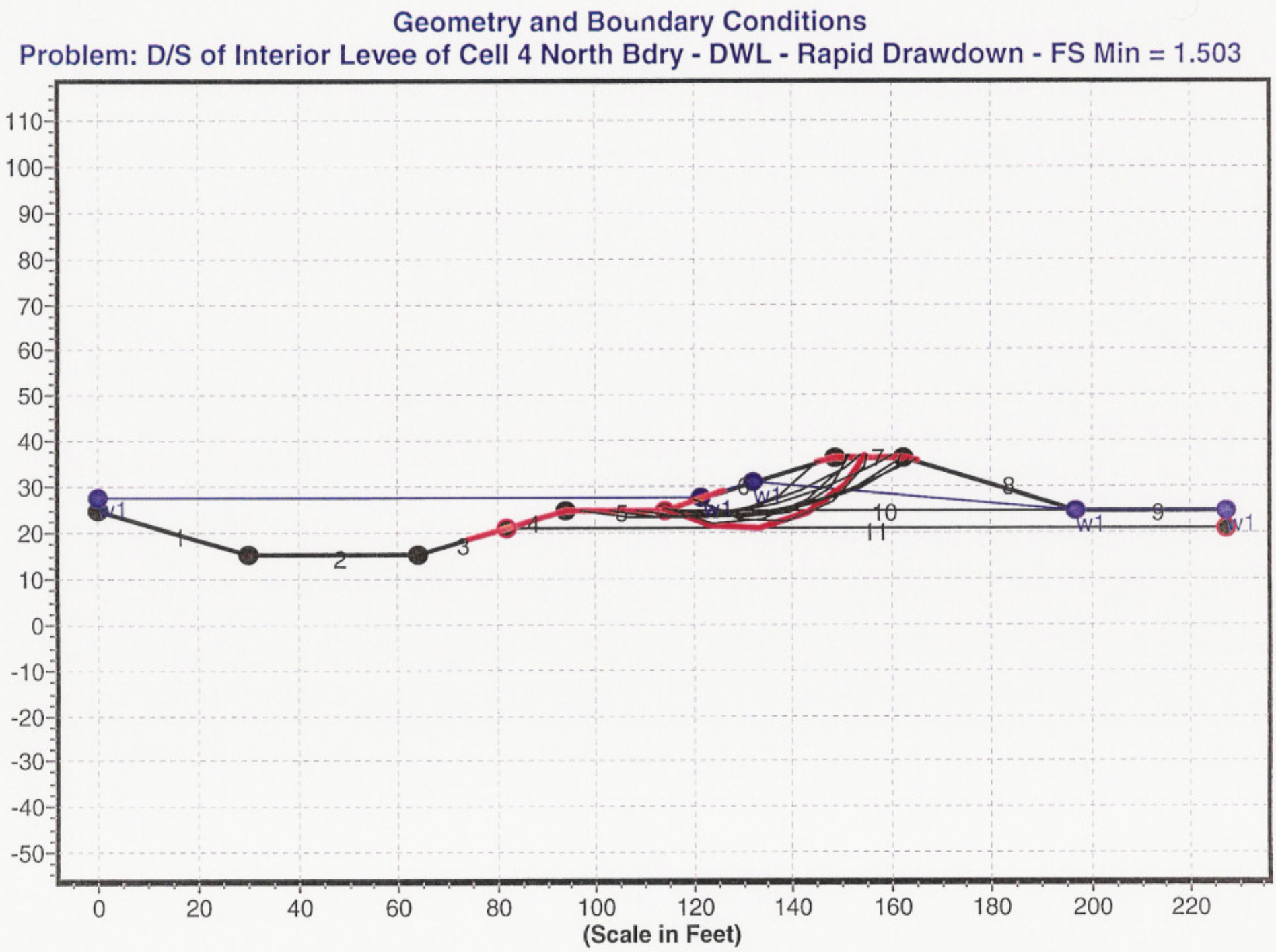
Problem: U/S of Interior Levee of Cell 4 North Bdry - DWL - Steady State - FS Min = 1.835



Geometry and Boundary Conditions

Problem: D/S of Interior Levee of Cell 4 North Bdry - MWL - Rapid Drawdown - FS Min = 1.178

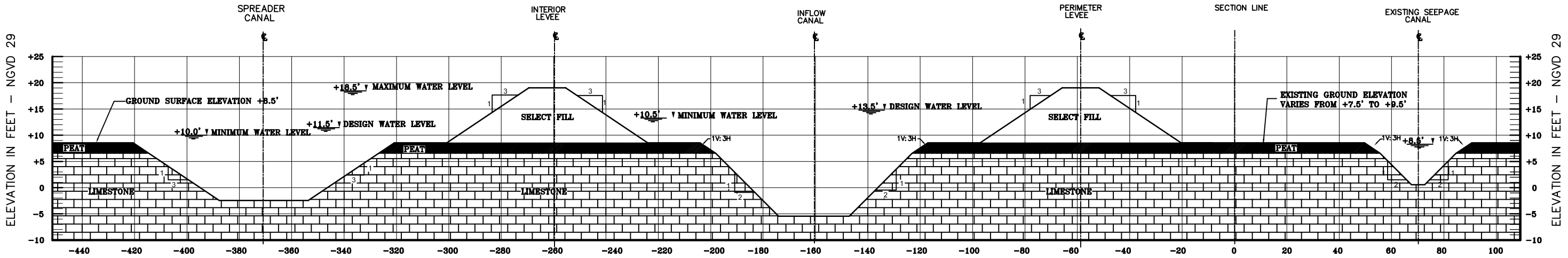


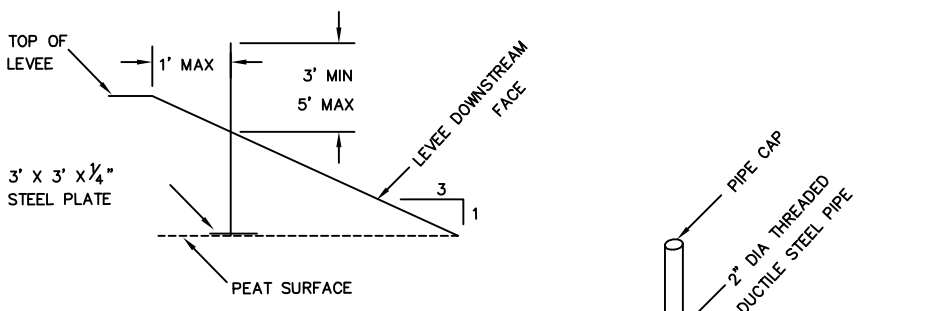

Geometry and Boundary Conditions
Problem: D/S of Interior Levee of Cell 4 North Bdry - DWL - Rapid Drawdown - FS Min = 1.503
110
100
90
80
70
60
50
40
30
20
10
0
-10
-20
-30
-40
-50
0
20
40
60
80
100
120
140
160
180
200
220
(Scale in Feet)
1
2
3
4
5
6
7
8
9
10
11
w1

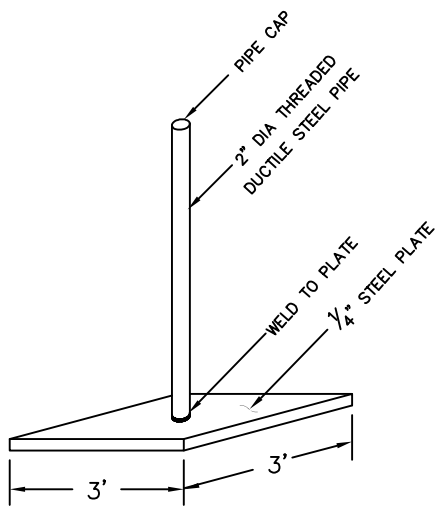
APPENDIX F

RADISE
Infrastructure Engineers • Software Developers

CROSS SECTION OF CELL 4 NORTH BOUNDARY





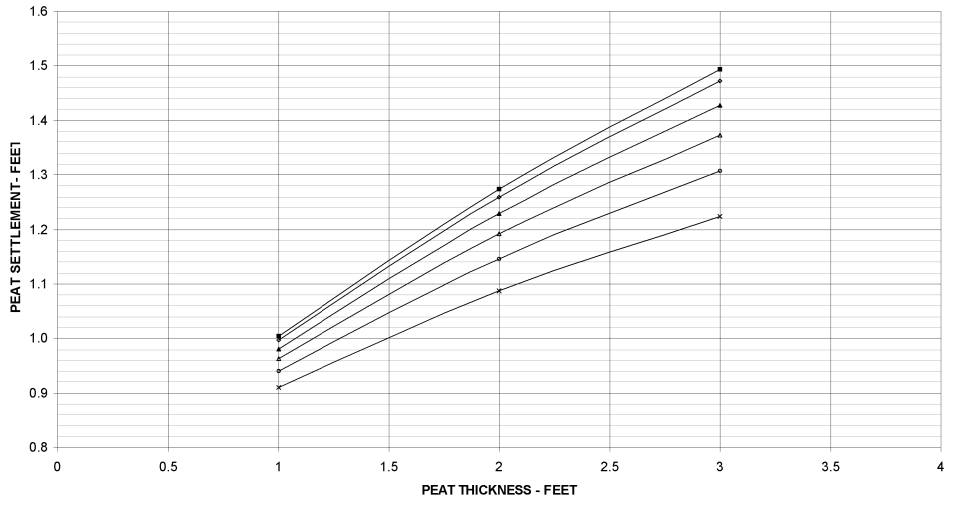


1. ESTABLISH ELEVATION OF PLATE INSIDE 2" PIPE AT START OF FILLING
2. READ TOP OF PIPE (TOP OF THREADS NOT CAP) AT START OF FILLING AND WEEKLY THEREAFTER FOR 1 MONTH AFTER FILLING TO CONSTRUCTION GRADE
3. EXTEND PIPES AS FILL RISES BY ADDING 5 FOOT SECTIONS, CHECK NEW TOP OF PIPE ELEVATION AGAINST BASE TOP OF PLATE ELEVATION

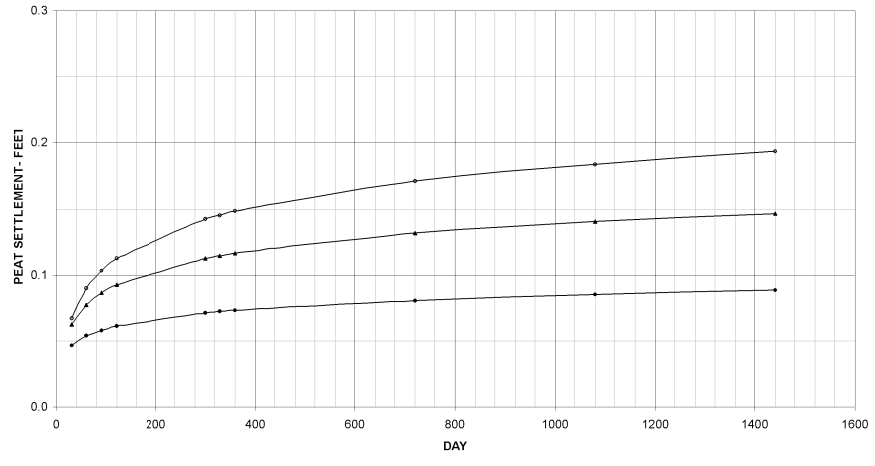
SETTLEMENT PLATE DETAIL (TYP)

NOT TO SCALE

END OF CONSTRUCTION SETTLEMENT
PEAT SETTLEMENT VS PEAT THICKNESS



SECONDARY CONSOLIDATION
DAY VS PEAT SETTLEMENT



REVISIONS							Names	Dates
Date.	By	Descriptions	Date.	By	Descriptions	Drawn by	EA	04/25/05
						Checked by	V V	04/25/05
						Designed by		
						Checked by		
						Approved by	K A A	

RADISE Infrastructure Engineers & Software Developers

LICENSE NO. - 8901

ENGINEER OF RECORD
KUMAR. A. ALLADY (P.E.No. - 52845)
RADISE International
4152 West Blue Heron Boulevard, Suite 116
Riviera Beach, Florida, 33404
TEL 561-841-0103 FAX 561-841-0104
URL : http:// www.radise.net

SOUTH FLORIDA WATER MANAGEMENT DISTRICT	
COUNTY	CONTRACT NO
PALM BEACH	CN040935

SCALE: VERTICAL 1" = 20'
SCALE: HORIZONTAL 1" = 40'

SHEET TITLE: LEVEE SETTLEMENT DETAIL

PROJECT NAME: STA 2/CELL 4 EXPANSION PROJECT
PALM BEACH COUNTY
FLORIDA

SHEET NO. 8

RADISE PROJECT NO: 04/RB/GEOT/0701

Z:\RADISE WORK\2004\P040701GB-BODR-REPORT\Report\BODR Submittal 04-28-2005\PDF format\Appendix F\LEVEE SETTLEMENT DETAIL (SHEET-8).dwg

SEEP2D FLOWNETS
(EFFECTS OF POOL ELEVATION)

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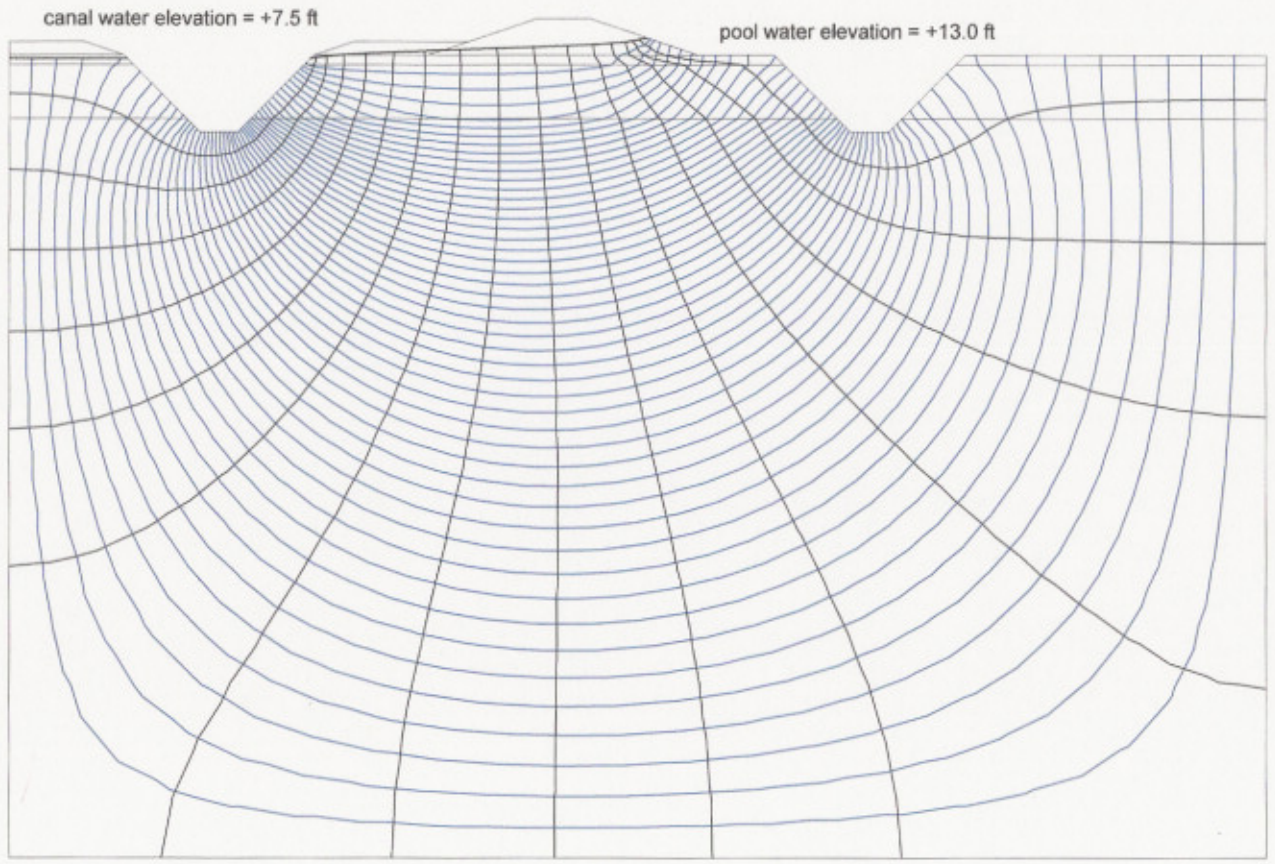
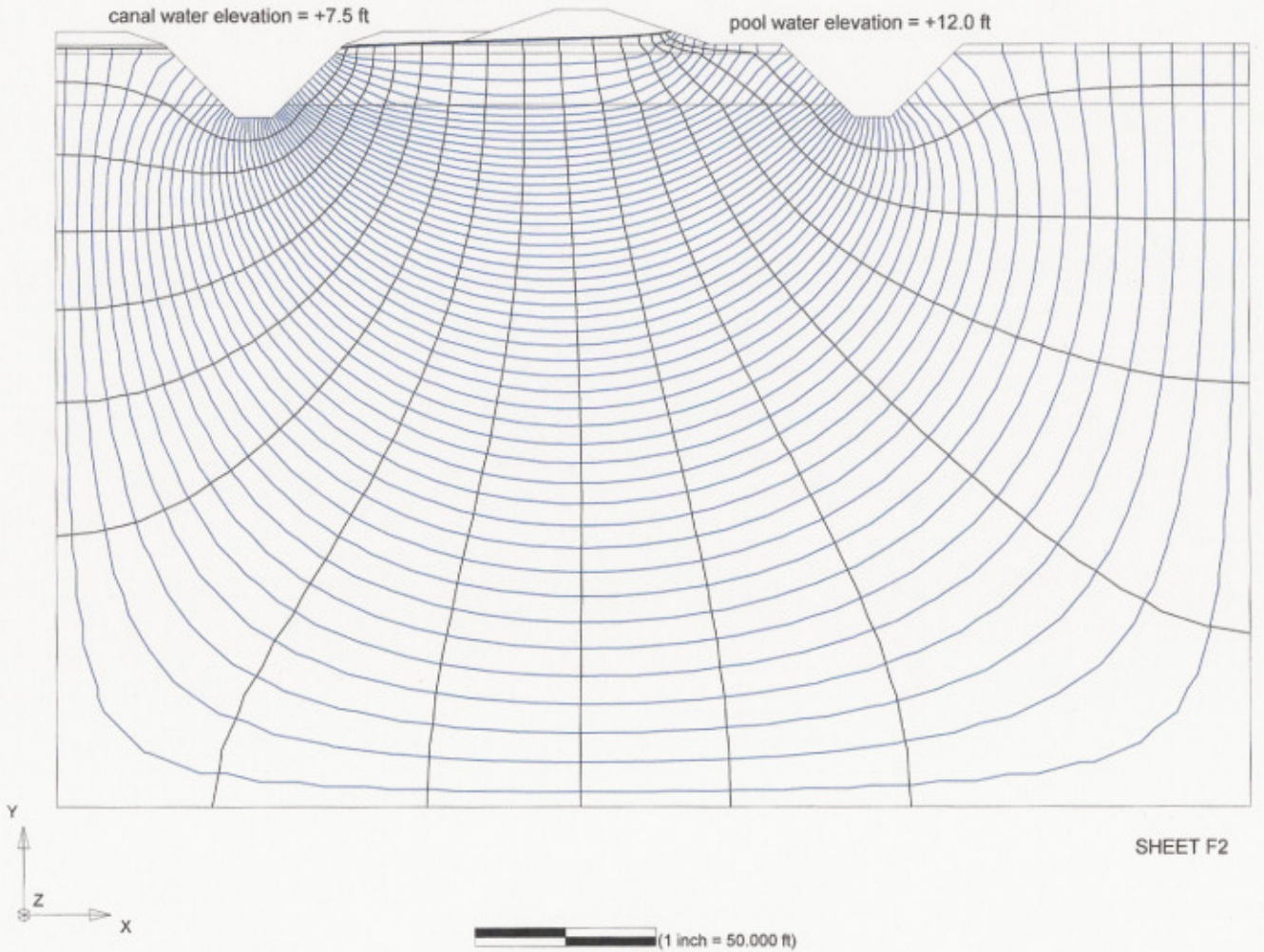
Infrastructure Engineers + Software Developers

TOTAL FLOWRATE = 3.66 CFS/MI/FT-HEAD



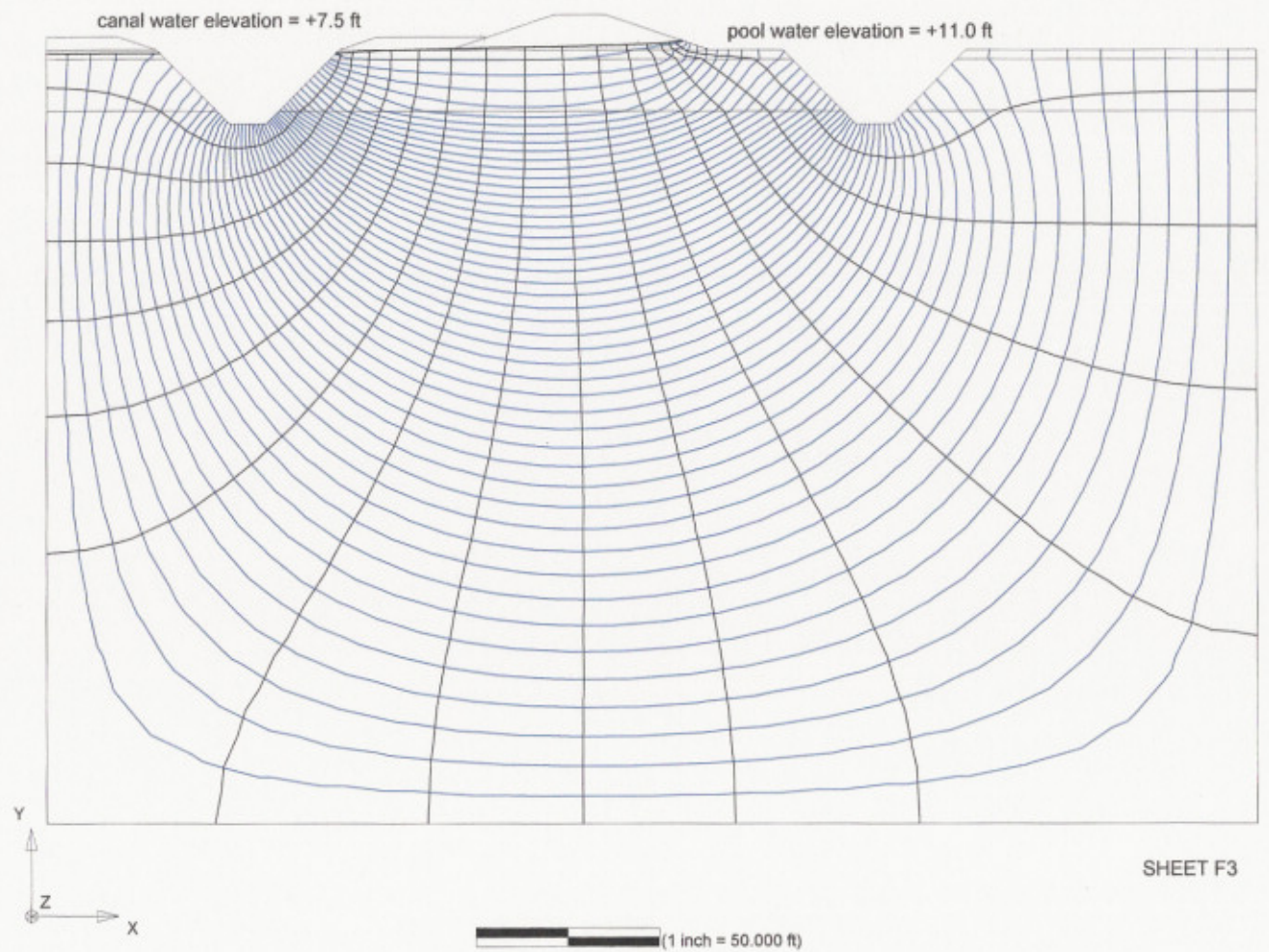
SHEET F1

TOTAL FLOWRATE = 3.63 CFS/MI/FT-HEAD



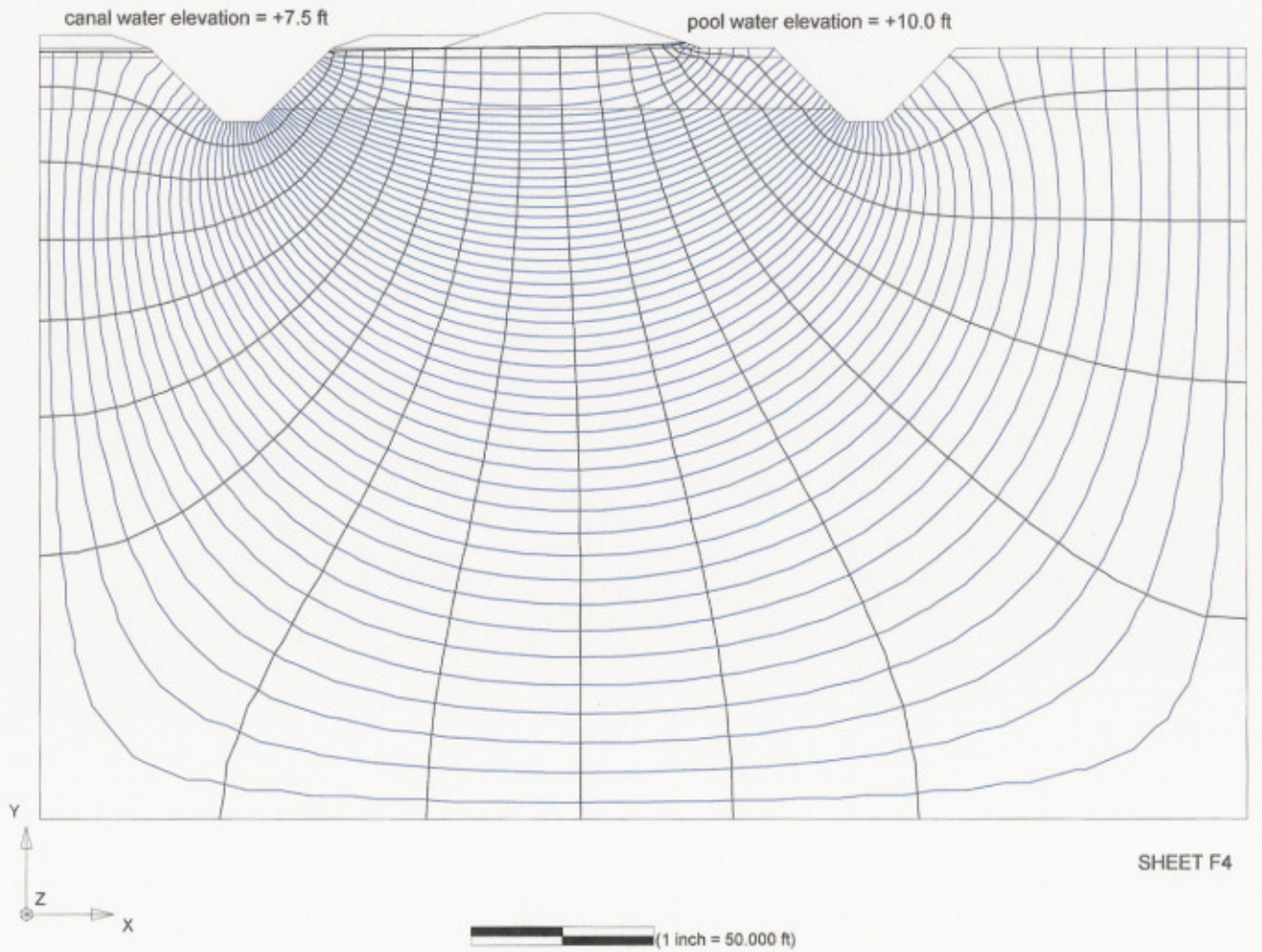
SHEET F2

TOTAL FLOWRATE = 3.60 CFS/MI/FT-HEAD



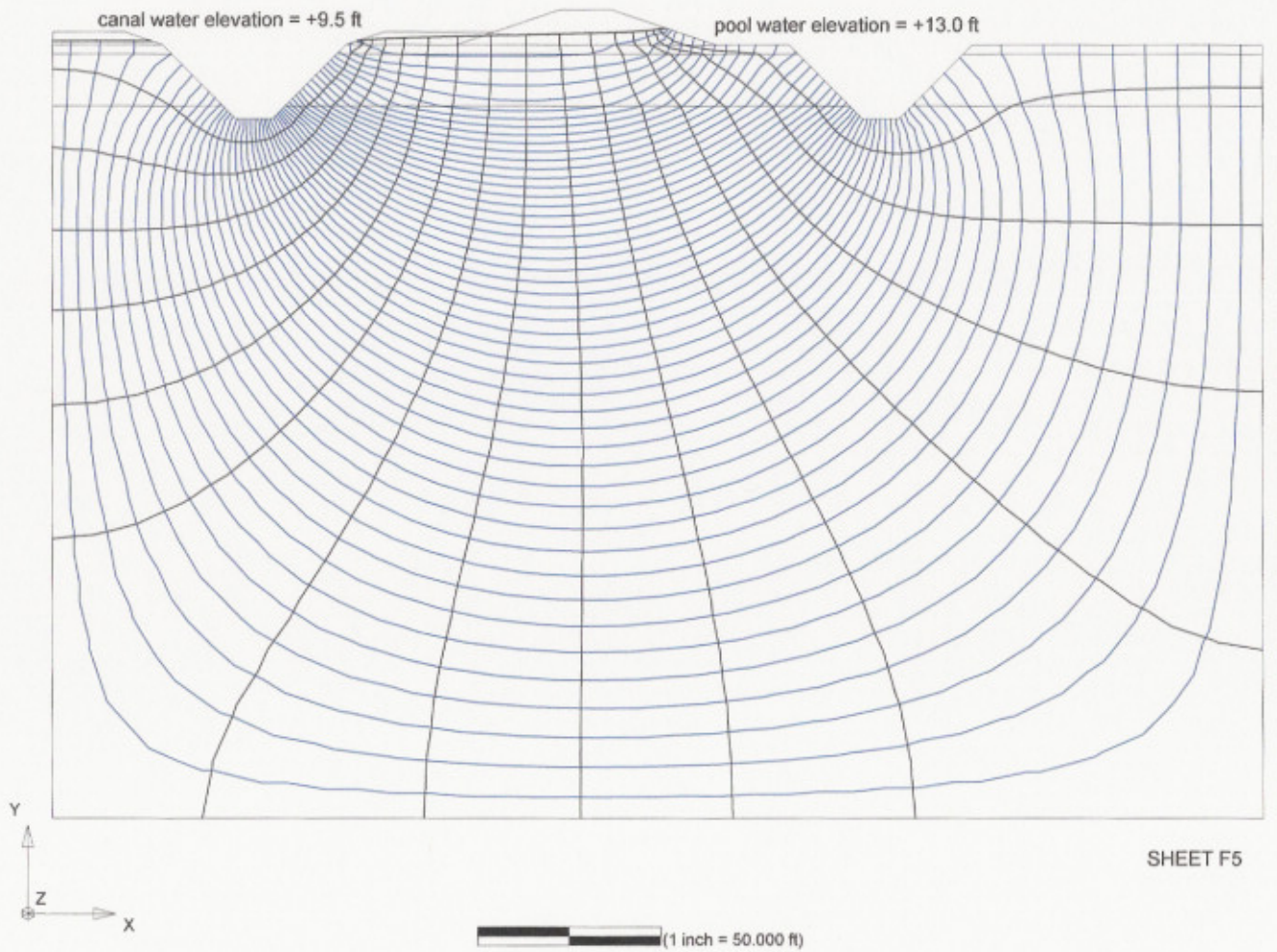
SHEET F3

TOTAL FLOWRATE = 3.57 CFS/MI/FT-HEAD



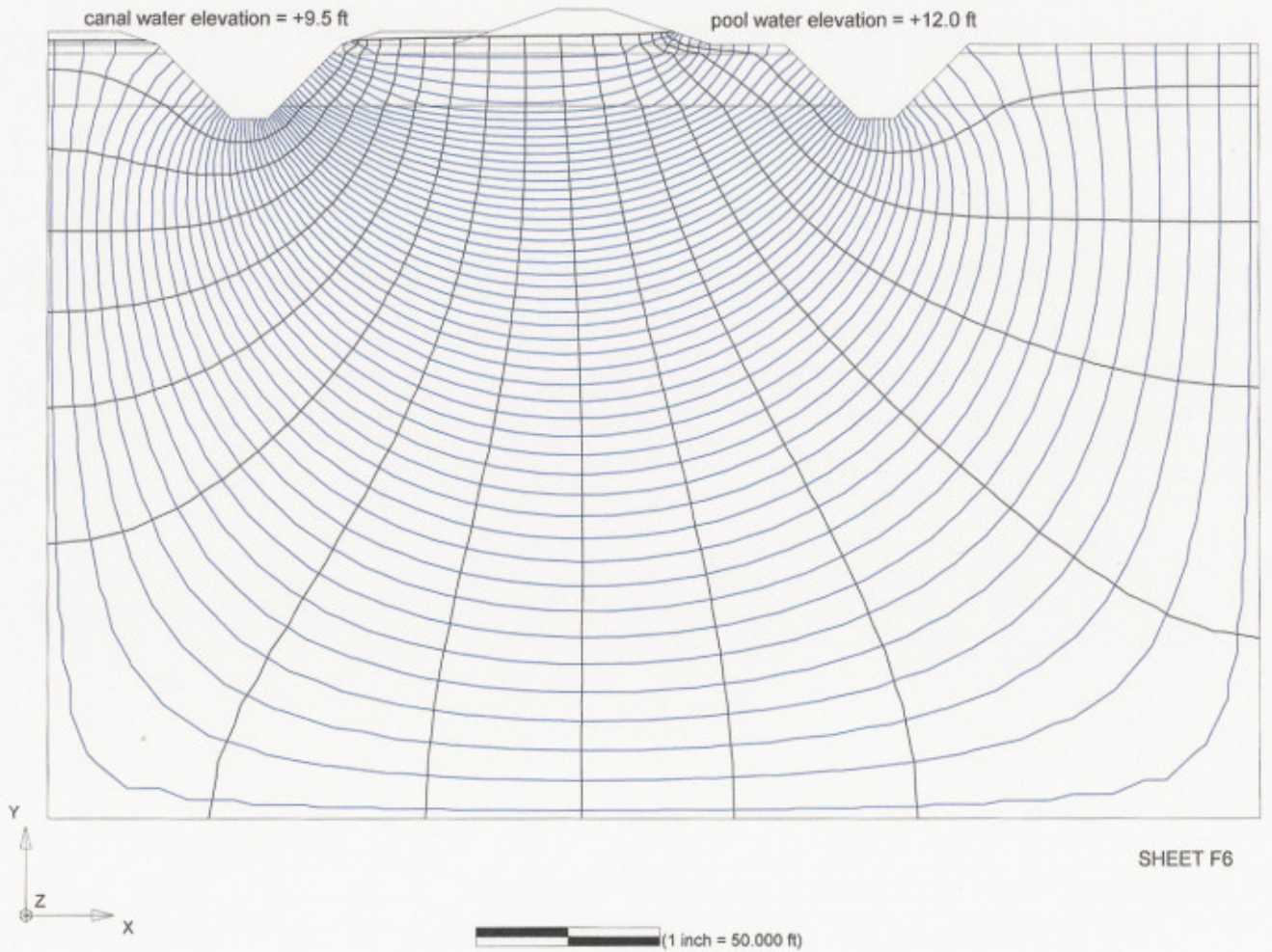
SHEET F4

TOTAL FLOWRATE = 3.69 CFS/MI/FT-HEAD



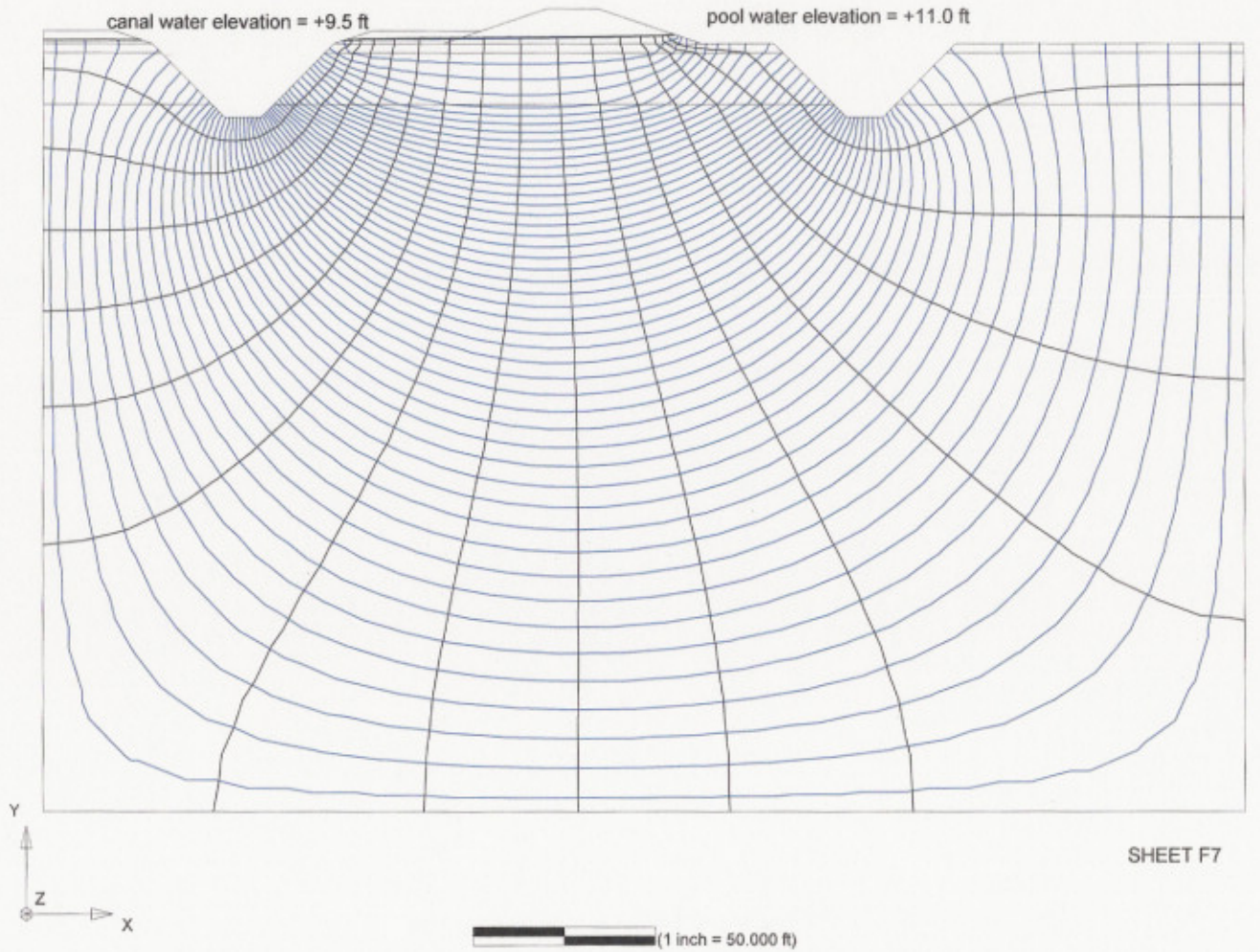
SHEET F5

TOTAL FLOWRATE = 3.66 CFS/MI/FT-HEAD



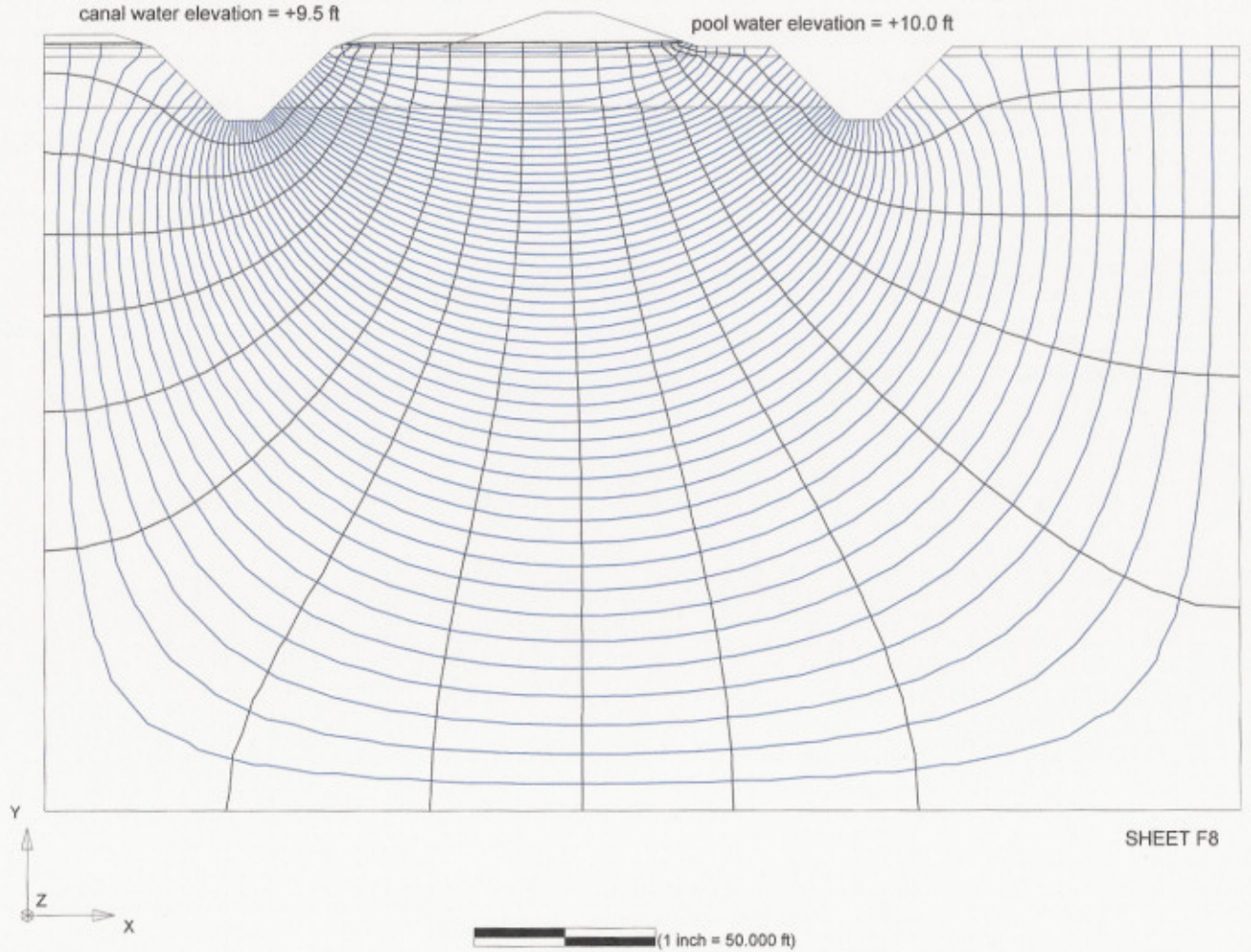
SHEET F6

TOTAL FLOWRATE = 3.63 CFS/MI/FT-HEAD



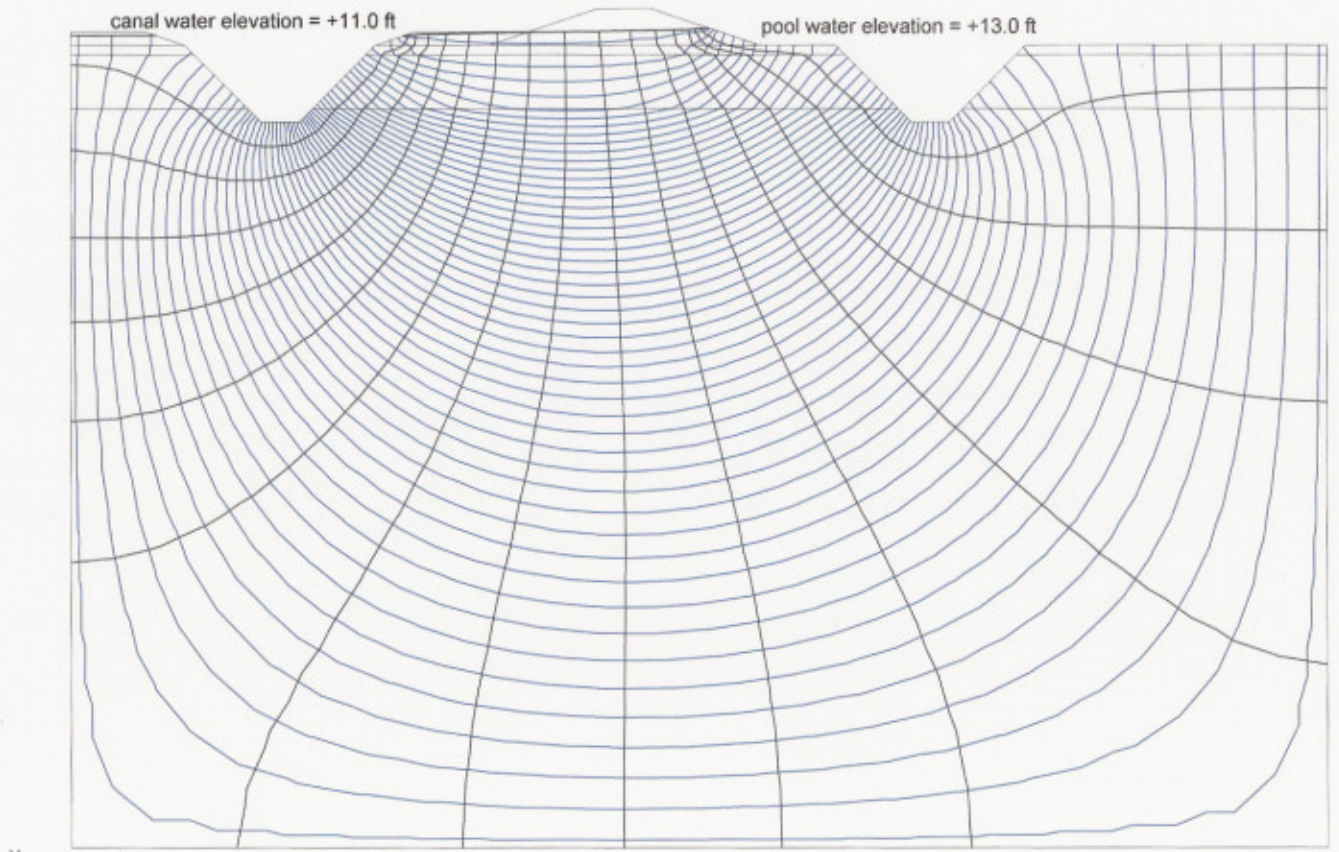
SHEET F7

TOTAL FLOWRATE = 3.59 CFS/MI/FT-HEAD



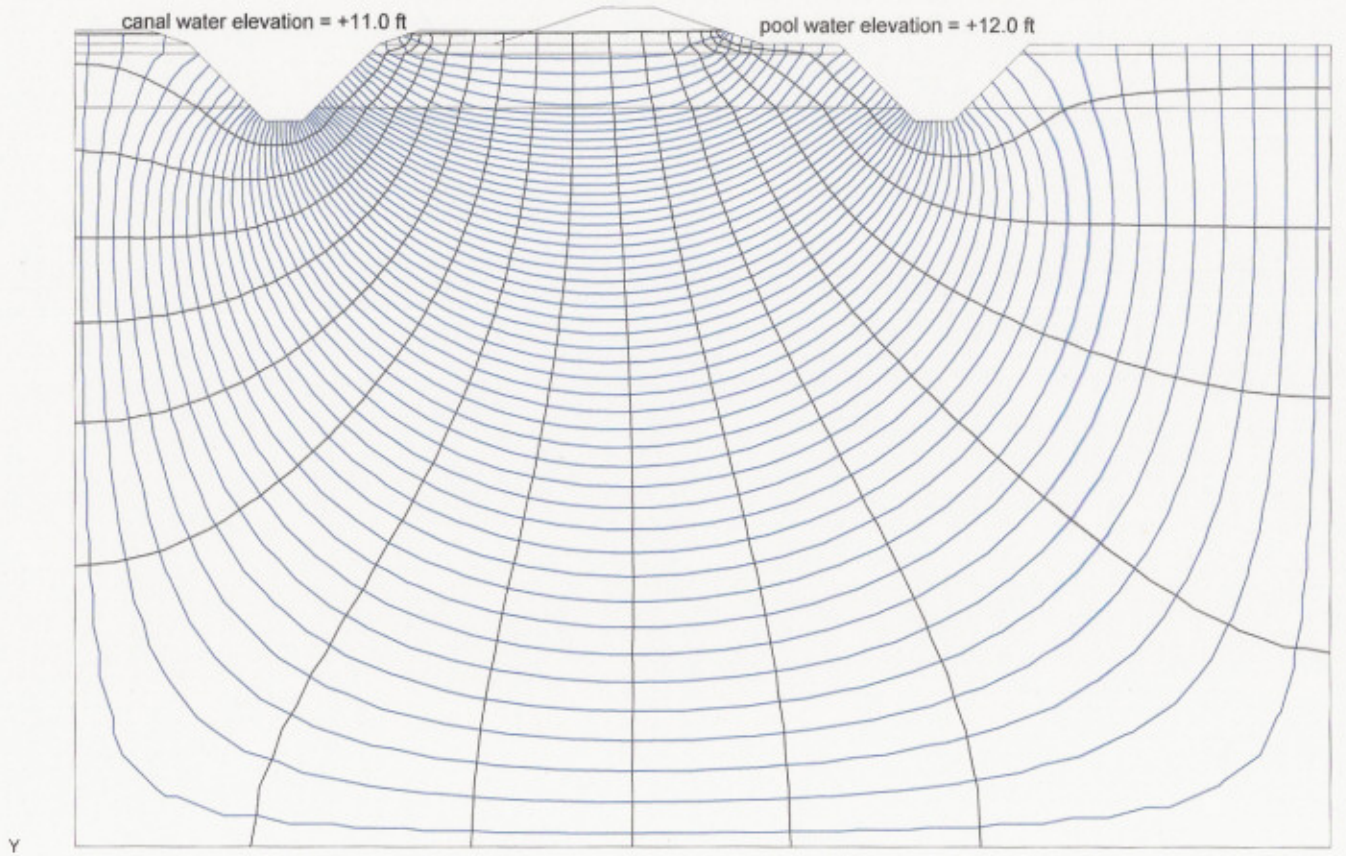
SHEET F8

TOTAL FLOWRATE = 3.71 CFS/MI/FT-HEAD



SHEET F9

TOTAL FLOWRATE = 3.68 CFS/MI/FT-HEAD



SHEET F10

SEEP2D FLOWNETS
(NORTH PERIMETER OF CELL 4)

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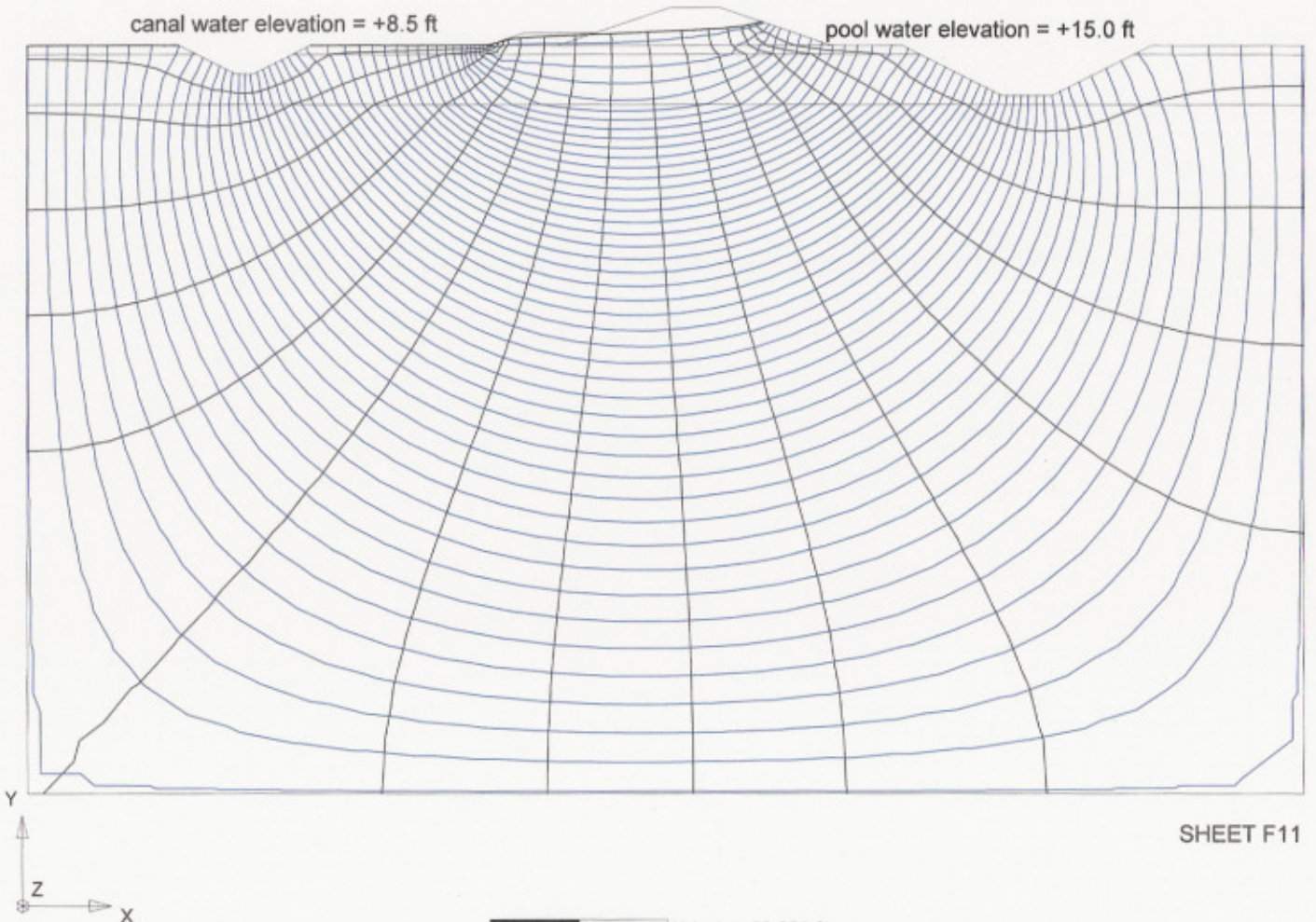
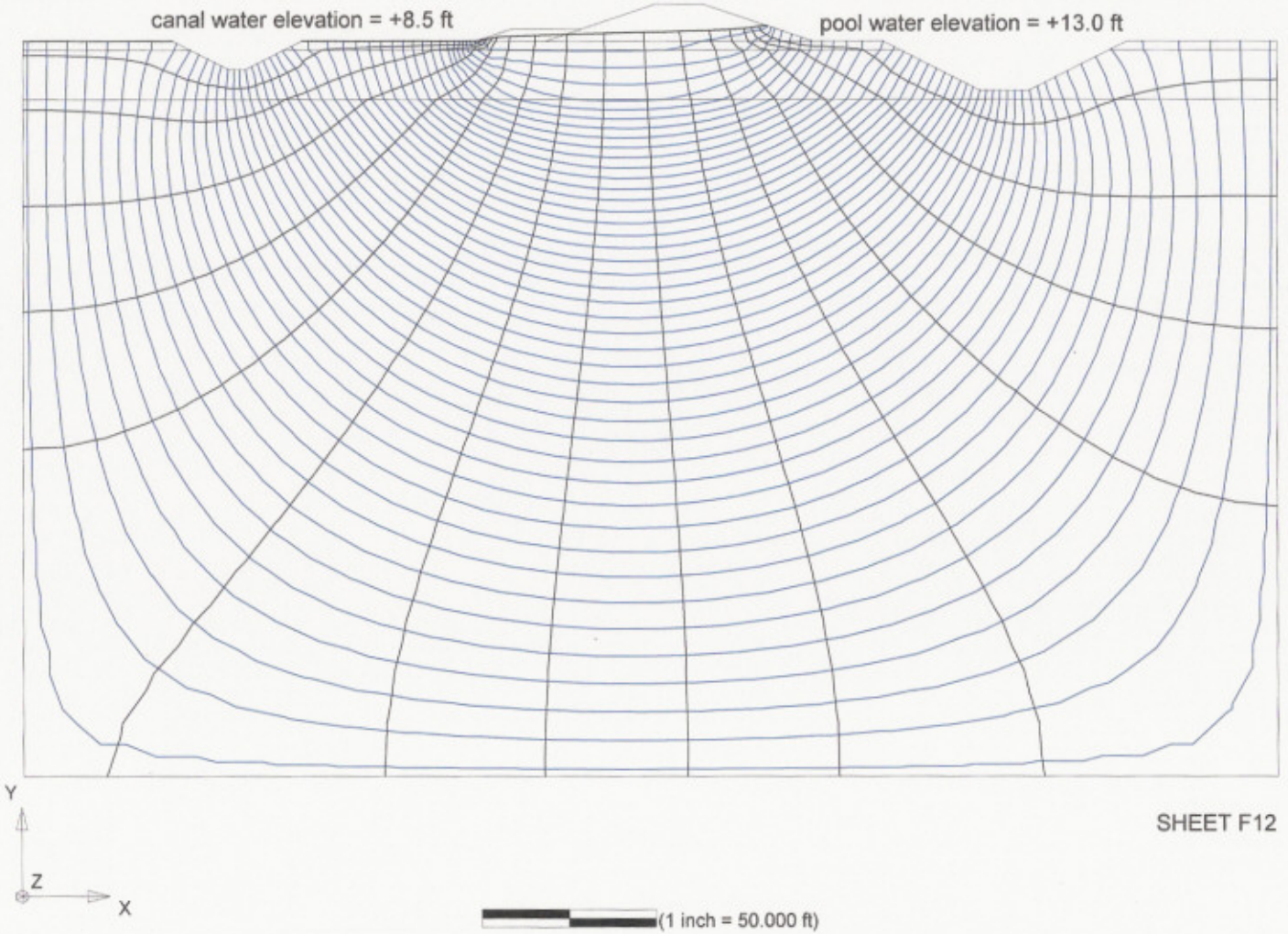
TOTAL FLOWRATE = 3.31 CFS/MI/FT-HEAD



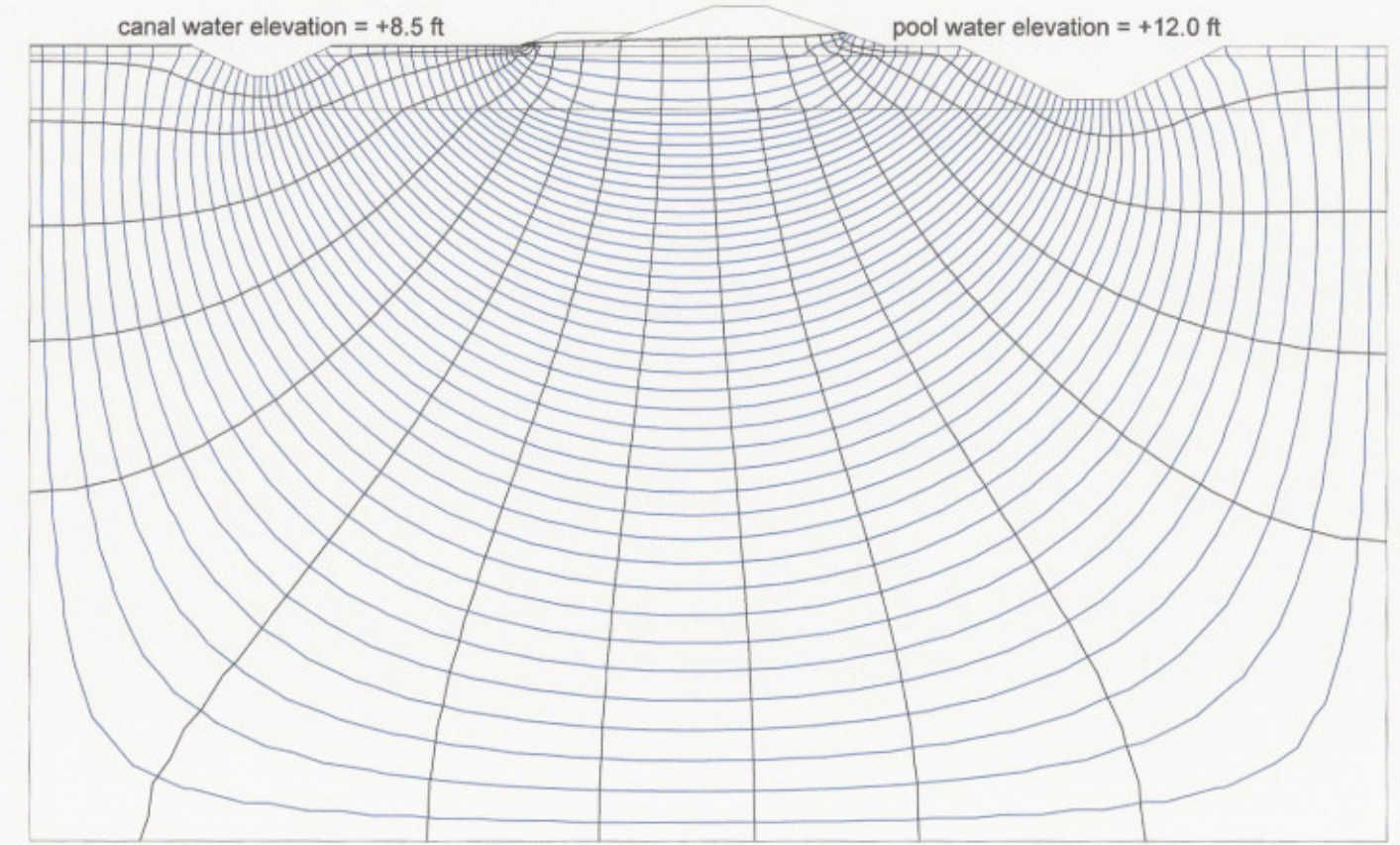
SHEET F11

TOTAL FLOWRATE = 3.25 CFS/MI/FT-HEAD



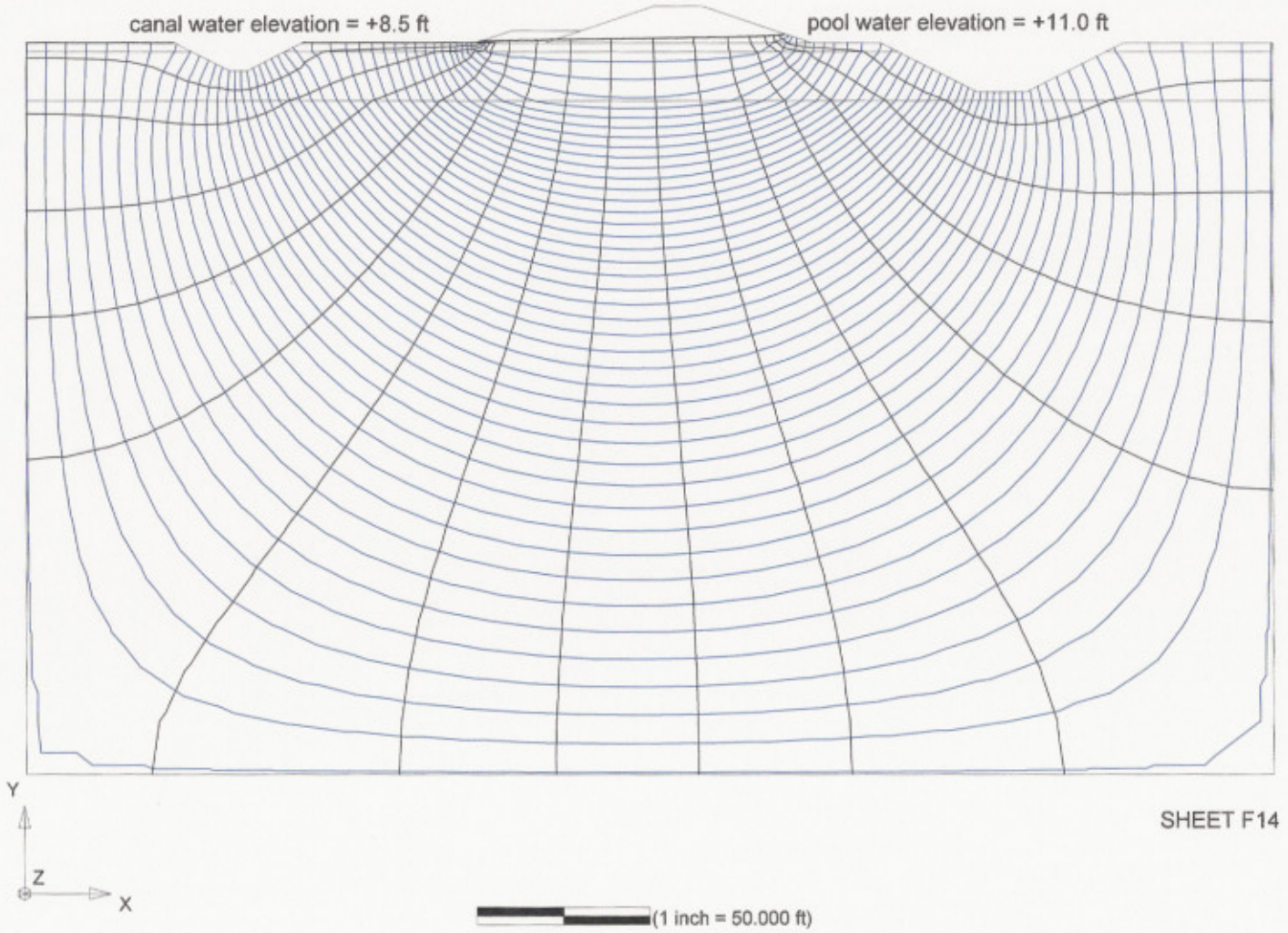
SHEET F12

TOTAL FLOWRATE = 3.23 CFS/MI/FT-HEAD



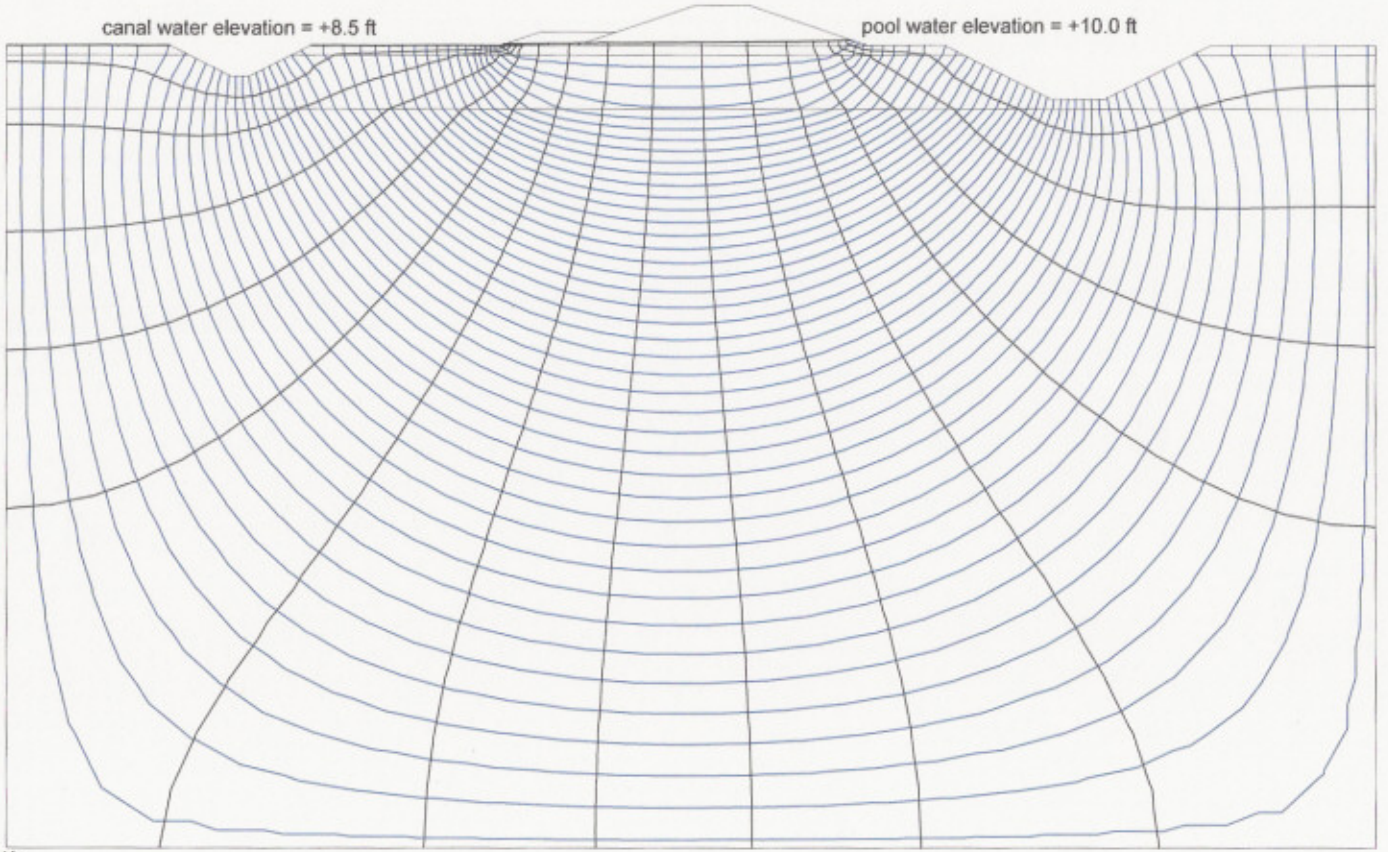
SHEET F13

TOTAL FLOWRATE = 3.20 CFS/MI/FT-HEAD



SHEET F14

TOTAL FLOWRATE = 3.17 CFS/MI/FT-HEAD



SHEET F15